# MACHINERY

## *Design—Construction—Operation*

**Volume 43** **OCTOBER, 1936** **Number 2**

**A most unusual investigation into the performance of machine tools from the point of view of accuracy will be recorded in the leading article in November MACHINERY, *The Accuracy and Performance of Machine Tool Spindles.* This article covers an investigation into the reasons why machines apparently identical in design and construction are not always equal in performance—some machines doing better work than others. The conclusions drawn are based on numerous tests. Charts are included clearly indicating the performance of different machines under varying conditions.**

### PRINCIPAL ARTICLES IN THIS NUMBER

FOR COMPLETE CLASSIFIED CONTENTS, SEE PAGE 168-F

New Fields of Application for Precision Surface Grinding *By Charles O. Herb* 97

What is Required in a Lubricant for Heavy-Duty Machinery? *By A. F. Brewer* 102

Machining Valves Weighing Sixty Tons for the Boulder Dam.. 104

How Important is the Cutting Oil in Tapping?..*By H. Goldberg* 108

The Hone is Now Used to Finish Narrow Work..... 110

Editorial Comment ..... 114

Excessive Taxation Puts the Brakes on Industrial Progress—Improved Machines Deserve Improved Accessories

Up-to-Date Heat-Treating Equipment at the Chevrolet Plant *By J. B. Nealey* 118

One Die-Casting Replaces Several Stampings *By Charles O. Herb* 122

The Eighteenth Annual National Metal Exposition..... 129

A Preview of Some Exhibits at the Cleveland Metal Show.... 130

Constantly Increasing Use of Nickel Steels and Alloys..... 135

Die-Castings Are Finding Many New Uses..... 136

New Applications of Synthetic Plastics..... 137

Condensed Review of Some Recently Developed Materials..... 138

Gear Manufacturers Meet on Board Ship..... 145

### DEPARTMENTS

Engineering News Flashes..... 106

Ideas for the Shop and Drafting-Room..... 113

Ingenious Mechanical Movements..... 115

Questions and Answers..... 121

Design of Tools and Fixtures..... 125

New Trade Literature..... 147

Shop Equipment News..... 149

Product Index 152-167

Advertisers Index 168

PUBLISHED MONTHLY BY
THE INDUSTRIAL PRESS
148 Lafayette Street New York

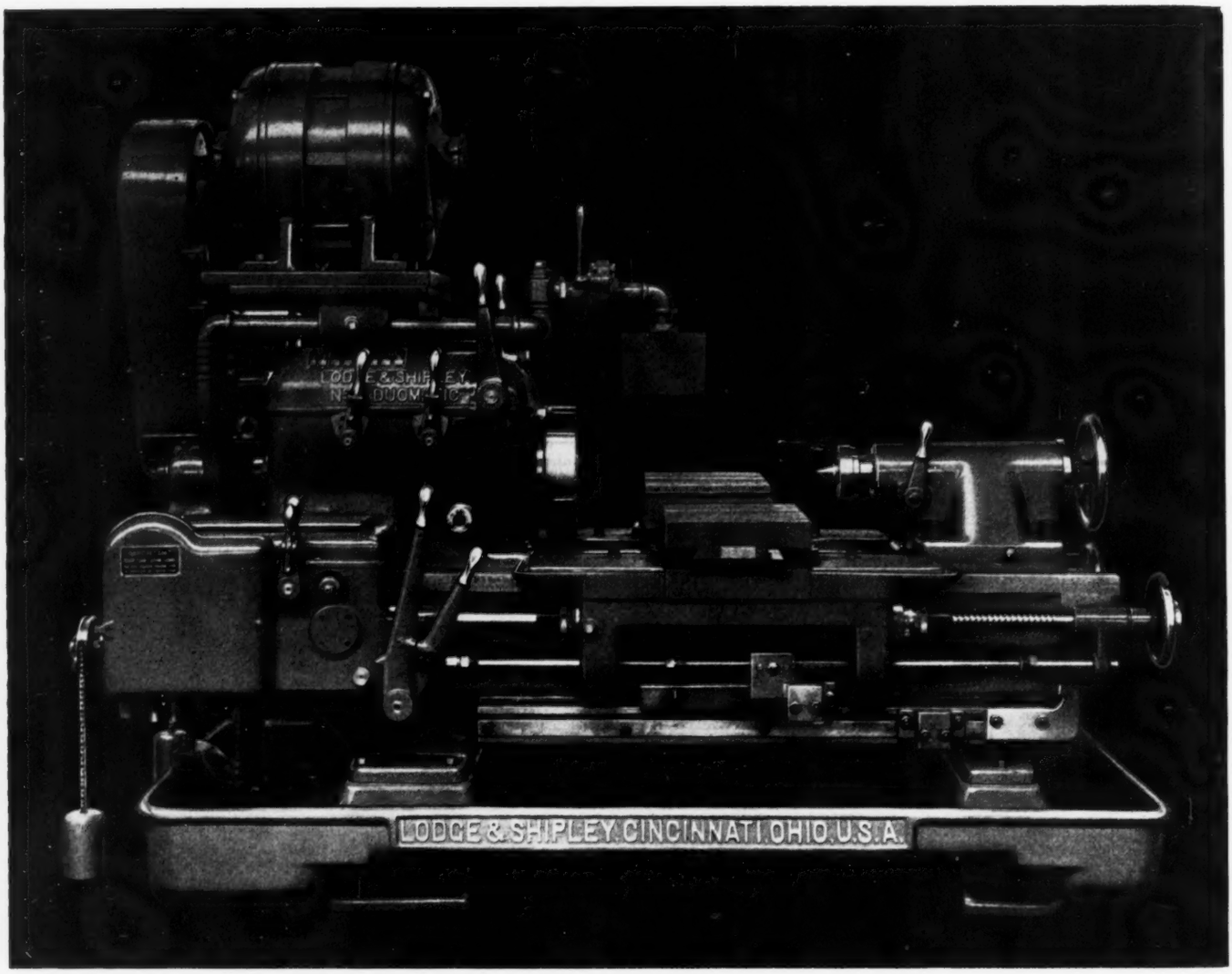
ROBERT B. LUCHARS .....*President*
EDGAR A. BECKER..*Vice-pres. and Treasurer*
ERIK OBERG .....*Editor*
FRANKLIN D. JONES ....*Associate Editor*
CHARLES O. HERB .....*Associate Editor*
FREEMAN C. DUSTON ...*Associate Editor*

LONDON: 52-54 High Holborn
PARIS: 15 Rue Bleue

YEARLY SUBSCRIPTION: United States and Canada, $3 (two years, $5); foreign countries, $6. Single copies, 35 cents.
Changes in address must be received by the fifteenth of the month to be effective for the forthcoming issue.
Send old as well as new address.

Copyright 1936 by The Industrial Press.
Entered as second-class mail matter, September, 1894, at the Post Office, New York. N. Y., under the Act of March 3, 1879.
Printed in the United States of America.
Member of A.B.P. Member of A.B.C.

CIRCULATION 15,572

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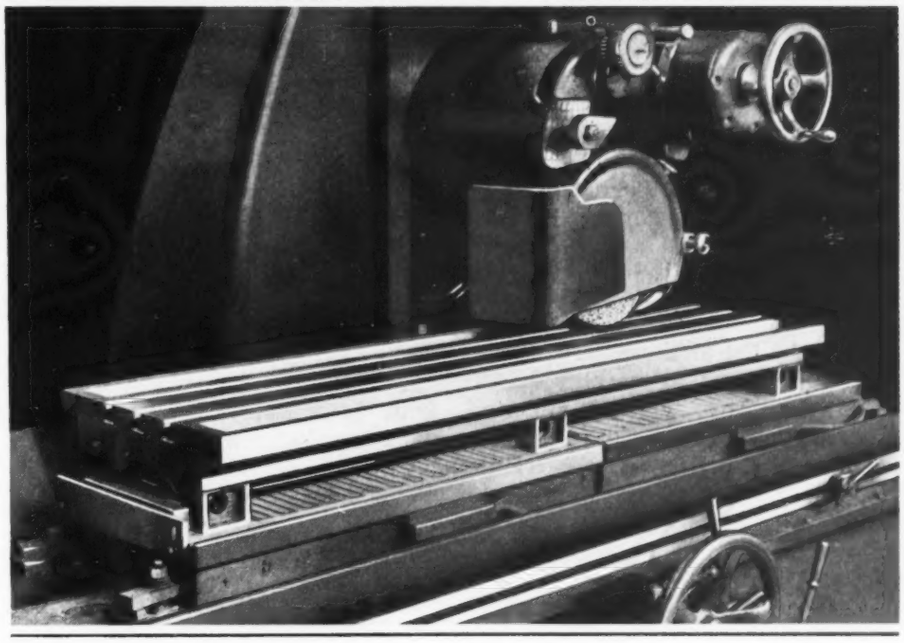
The Lodge & Shipley No. 3 Duomatic—a general purpose automatic lathe—high production capabilities—versatile and accurate—wide range of feeding cycles—selective range of spindle speeds—the lathe that will bring "More Minutes per Hour" to your shop.

## THE LODGE AND SHIPLEY MACHINE

MACHINERY

Volume 43 NEW YORK, OCTOBER, 1936 Number 2

# *New Fields of Application for Precision Surface Grinding*



*Machine Tool Beds and Tables, Hardened Steel Ways, Stamping Dies, and Numerous Other Parts can be Rough-Ground with Heavy Cuts and then Finish-Ground within a Few Ten-Thousandths of an Inch on the Same Machine*

*By CHARLES O. HERB*

BACK in 1928, the Mattison Machine Works, Rockford, Ill., had been machinery builders for a period of thirty years. In routing the work through the shop, need had been felt for a surface grinding machine of considerable size that would have sufficient power to "hog" off stock and yet would be accurate enough to finish long pieces within a few ten-thousandths of an inch.

The decision was reached to build a machine of these capabilities in the Mattison shop, in order that certain ideas of design could be incorporated. The first machine, built in 1930, was so successful that it was decided to build it for the industry. Since that year, the concern has been building precision surface grinding machines, in addition to other grinding and polishing machinery.

Unusual rigidity that enables both heavy roughing and light finishing cuts to be taken is obtained

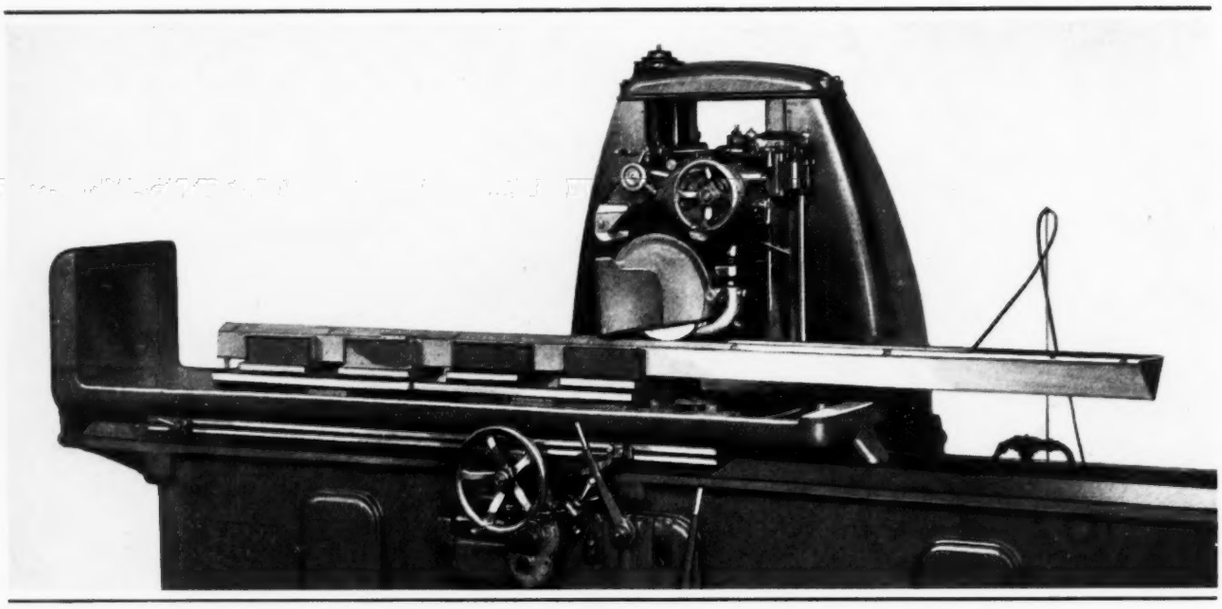


*Fig. 1. Hardened Steel Way 13 Feet Long which is Ground on Two Angular Sides and the Top and Bottom, within Plus or Minus Limits of 0.0005 Inch for the Entire Length*

in these machines by the provision of two vertical columns that support the grinding-wheel slide. These columns are tied together at the top by a cross-member, and are bolted at the bottom to the bed of the machine. The grinding wheel is driven by a built-in motor, the rotor of which is mounted directly on the wheel-spindle. Thus the full power of the motor is delivered to the wheel. Hydraulic power reciprocates the table at any speed from 30 to 100 feet a minute. The cross-feed mechanism for the wheel is also actuated hydraulically at each end of the table stroke. Any cross-feed up to 2 inches is obtainable. Raising and lowering of the grinding-wheel slide on the columns are effected electrically by merely depressing push-buttons.

These precision surface-grinding machines are built in two models, the smaller of which is equipped with a grinding wheel 16 inches in diameter by 3 inches face width. Tables 12 or 14 inches wide and 3, 4, or 5 feet long can be provided. The larger machine has a grinding wheel 16 inches in diameter by 6 inches face width. This model may be

*Fig. 4. There are Sixty Holes 2 Inches in Diameter in This Machine-steel Slab that had to be Parallel within 0.0002 Inch, even at the Edges of the Holes*

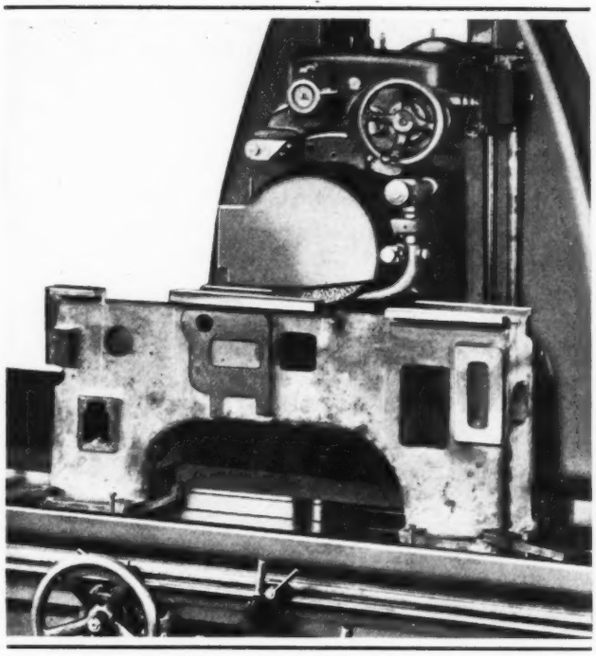


*Fig. 2. Grinding the Flat Top Surface and the Vertical Edge of Hardened Steel Ways on the Bed Casting for a Screw Machine*

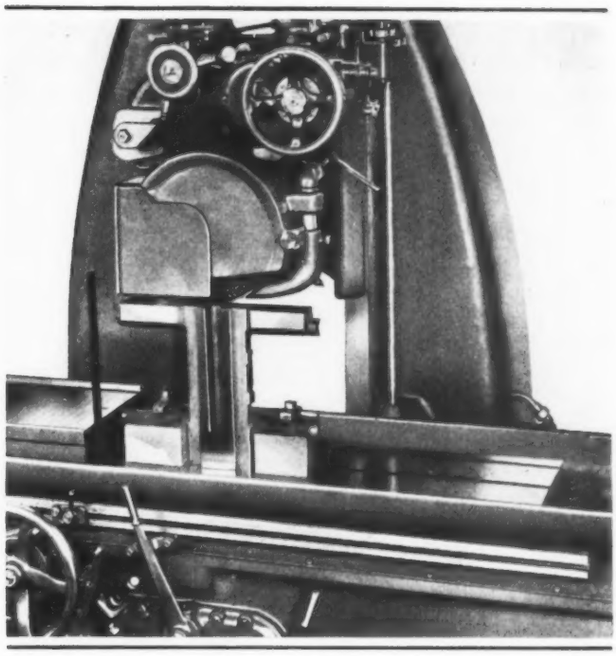


*Fig. 3. The Ends of a Lathe Carriage were Surface Ground on This Machine after Removing One of the Magnetic Chucks*

equipped with tables 16, 20, or 24 inches wide and of various lengths from 6 to 12 feet.

The application of precision surface grinding to some machine tool parts has been so successful as to greatly reduce the amount of hand scraping previously required to obtain accurate surfaces. In one shop where table ways were formerly scraped for forty hours, the ways are now surface ground in six hours, and it is claimed that the accuracy is even greater than when they are scraped. The heading illustration shows a milling machine table being ground on the top surface. This table measured 70 inches in length by 17 inches in width and was ground flat within 0.0005 inch over its entire surface.

Hardened steel ways for a steel-sheet grinding machine were finished in the manner shown in Fig. 1. Six of these ways were required, each 13 feet long. Approximately 0.025 inch of stock was removed from the two angular surfaces, top and

*Fig. 5. Grinding Several Hundred Interrupted Surfaces on Hardened Steel Chain Links at the Rate of 126 Pieces an Hour, Tripling Previous Production Rates*

bottom. When finished, all surfaces had to be true within 0.0005 inch for their entire length. Because the ways were much longer than the table of the surface grinding machine, only half their length could be ground in a set-up, so that each way had to be set up eight times before it was completely ground. Even so, the time for the entire lot of six pieces was only thirty hours, or five hours for each way.

Hardened steel ways of a bed for a screw machine are shown being ground in Fig. 2. This operation consists of grinding the flat top surface of each way and also the vertical edge. The limits on this job are extremely close. The work was formerly finished on a planer equipped with a grinding attachment and the grinding time was ten hours. The job is now being completely ground in two hours.

Four pad surfaces and the long ends of the lathe carriage shown in Fig. 3 were finish-ground within thirty minutes, about 0.015 inch of stock being removed from all surfaces. The carriage casting was 17 inches high and it could be accommodated only by removing one section of the magnetic chuck to permit clamping the casting directly on the machine table.

### *Grinding Parts with Interrupted Surfaces to Close Limits of Accuracy*

Parts having holes or other interrupted surfaces are often considered difficult jobs for surface grinding machines when the top and bottom surfaces must be ground parallel, because unusual machine rigidity is essential in order to prevent the grinding wheel from "jumping" or "dropping" down slightly each time it reaches the spaces between the surfaces being ground.

Fig. 4 shows an operation of this kind. There are sixty holes 2 inches in diameter in the machine-steel slab shown on the surface grinding machine. This slab is 50 inches long by 17 inches wide and is 1 1/8 inches thick. The two sides had to be parallel at all points, including the edges of the holes, within 0.0002 inch. Roughing and finishing cuts were taken on both sides to remove 0.025 inch of stock from each side. The complete operation took 1 1/2 hours.

Fig. 7 shows a hardened blanking die being resharpened. About 1/32 inch of stock is removed in this operation, and the top surface of the die must be flat within 0.0002 inch, including the edge of the internal opening and also the outside edges. This die is regularly resharpened in twenty minutes, floor-to-floor time, even though two settings of the die are required, due to its being wider than the machine table. The die is first ground for half its width and then turned end for end on the machine to complete the job.

### *Grinding a Large Number of Pieces in One Set-up*

The adaptability of surface grinding machines for finishing many parts in one set-up is well known. An unusually interesting operation of this type is shown in Fig. 5. There are eighty-four chain links of hardened steel on this machine. These links must be ground on the top and bottom, approximately 0.015 inch of stock being removed from each side. On one side, the links are flat, but on the other side there are a number of projections to be ground. When the projections are uppermost, as shown, there are several hundred interrupted surfaces. These links are ground at the rate of 126 pieces an hour.

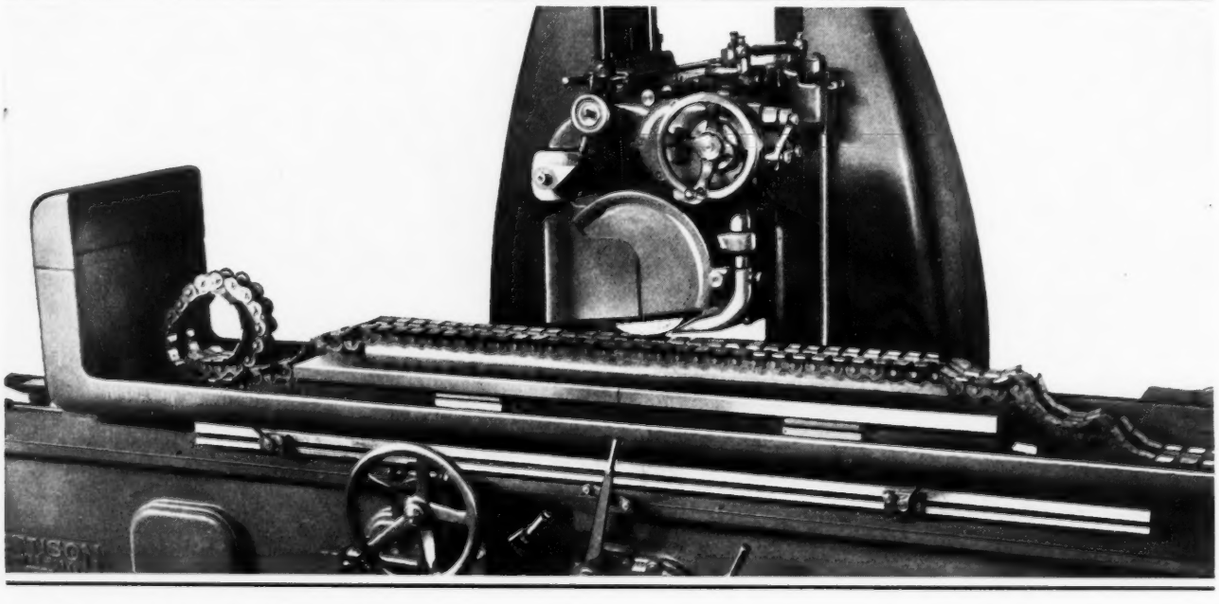


*Fig. 6. Grinding Flat Surfaces on the Links of a Chain 12 Feet Long by the Use of a Jig*

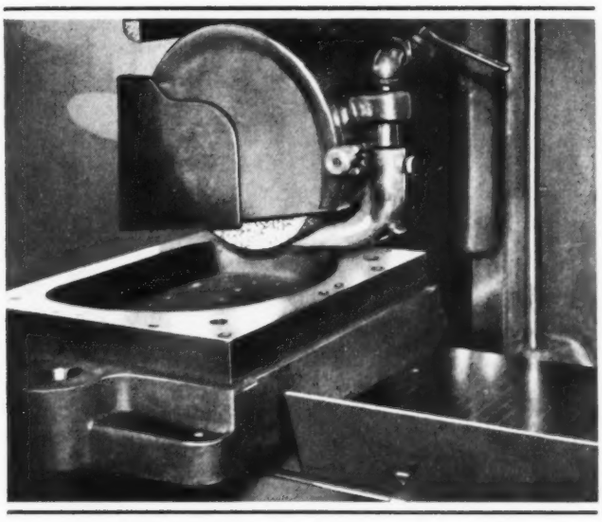


*Fig. 7. Precision Surface Grinding has Proved Particularly Satisfactory in the Tool-room for Grinding Die-blocks and Other Parts with Interrupted Surfaces to Close Limits of Accuracy*

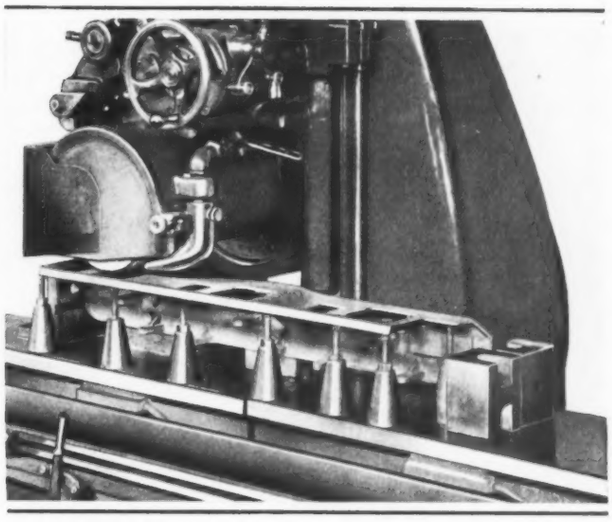


*Fig. 8. Grinding a Long Stainless Steel Casting of Thin Section that Had to be Supported by Screw Jacks along One Edge and Prevented from Sliding Endwise because It was Non-Magnetic*

An unusual method of grinding flat surfaces on the links of a chain 12 feet long is shown in Fig. 6. Chains of this type are used on a woodworking machine for driving purposes and must be reground from time to time. Formerly, the chains were disassembled into four lengths for regrinding, but it has now been found possible to grind the assembled chains in three settings. By laying the links in a suitable jig, these settings are quickly made. The over-all width of the surfaces ground is 5 1/4 inches, and about 0.015 inch of stock is ground off. The entire chain can be reground within 1 1/2 hours.

A stainless-steel casting 48 inches long, 8 1/4 inches wide, and 3/16 inch thick is shown being ground in Fig. 8. Since the piece was non-magnetic, provision had to be made to prevent it from sliding endwise during the operation. Screw-jacks were used to support the projecting front edge. Approximately 1/16 inch of stock was ground from this piece, the operation being completed in 1 1/4 hours, including the set-up time.

# Corrosion-Resistant Metals in Machine Design

A SYMPOSIUM on corrosion-resistant metals in the design of machinery and equipment, which promises to bring forth some very valuable information to those engaged in the mechanical industries, will be held as part of the annual meeting of the American Society of Mechanical Engineers in New York City, November 30 to December 4. The symposium is so arranged that when the different papers are assembled, they will form a reasonably complete handy reference covering the subject of corrosion-resistant metals. The symposium will occupy the entire day of Thursday, December 3, with sessions in the morning, afternoon, and evening. T. H. Wickenden, past chairman of the Society's Iron and Steel Division, has been appointed chairman of the committee that is arranging these sessions.

The papers to be presented are as follows: "Introduction to Corrosion-Resisting Metals," by Dr. F. N. Speller, National Tube Co., Pittsburgh, Pa.; "Alloys of Aluminum," by E. H. Dix, Jr., Aluminum Co. of America, New Kensington, Pa.; "Nickel and Nickel-base Alloys," by F. L. LaQue, International Nickel Co., Inc., New York City; "Zinc in the Chemical Industries," by E. A. Anderson, New Jersey Zinc Co., Palmerton, Pa.; "Lead," by G. O. Hiers, National Lead Co., Brooklyn, N. Y.; "Cast Iron in Chemical Equipment," by Dr. H. L. Maxwell, E. I. du Pont de Nemours Co., Inc., Wilmington, Del.; "Copper and Copper-base Alloys," by R. A. Wilkins, Revere Copper & Brass, Inc. Rome, N. Y.; and "Corrosion-resistant Steel (Stainless Type)," by J. H. Critchett, Union Carbide & Carbon Research Laboratories, Inc., New York City.

# What is Required in a Lubricant for Heavy-Duty Machinery?

**A Review of the Conditions under which Heavy-Duty Lubricants are Used and a Brief Summary of Their Characteristics**

By A. F. BREWER, Mechanical Engineer
The Texas Co., New York City

CERTAIN types of industrial machinery are subject to operating conditions that impose a severe load on the lubricant. Frequently these conditions include more than load or pressure, which is usually thought of as an evidence of heavy duty. Wide temperature ranges, high speeds, and possible injury to working parts through contaminated lubricants must also be considered; hence the necessity for thinking beyond the general idea of "extreme pressure" when selecting such lubricants. To meet this type of service, there must be a balance between the essential properties of lubricants. Viscosity, body, or consistency normally receives prior consideration, according to the method of lubrication, bearing design, or type of housing.

Viscosity is to some extent indicative of load carrying capacity. In fact, before the advent of "extreme pressure lubricants," it used to be regarded as the predominating characteristic of an oil for such service, on the assumption that the heavier-bodied products would better resist the squeezing-out effect of heavy journal or gear-tooth loads. Later, however, resistance to shear and film strength were proved to be more related to the chemical nature of the lubricant, a definite chemical reaction between the lubricant and the metallic surfaces under load being required; hence, the addition of certain metallic soaps or compounds of sulphur or chlorine, which the chemistry of petroleum had proved conducive to this reaction. The reaction is accelerated by high temperatures and is more active on metallic surfaces that are not highly polished. Consequently, even though the physical body or viscosity may be materially reduced at these high temperatures, the pressure resisting qualities of the lubricating film become enhanced by its active chemical constituent and the generation of an auxiliary layer of iron sulphide or iron chloride.

Petroleum research has further proved that the greater the smoothness or polish of the metallic surfaces to be lubricated, the more tenacious and resistant to pressure will be a film of straight mineral oil; hence, the trend in machine manufacture to use more care in the machining of journal bearing and gear-tooth surfaces. The automotive industry is to be commended for its progress in this regard; likewise, the abrasive and machine tool industries for developing more effective grinding materials and high-speed grinding machinery. It is perfectly obvious that where the ideal in lubrication is desired, straight mineral oil will do the work. This is to be preferred, because chemical agents, regardless of their value as film strength intensifiers, may give rise to abrasion and perhaps corrosive chemical reactions, especially in the presence of moisture.

### *The Flash and Fire Points of a Lubricant Have Little Bearing on its Lubricating Value*

Flash and fire points are often discussed where lubrication must be maintained at comparatively high temperatures. Their relation and importance to lubricating value are not, however, considered seriously today. To an extent, dependent upon the viscosity, they are related to vaporization, for they vary directly with the viscosity. It is for this reason that heavier bodied oils are preferred for such service; the loss through vaporization is less, and consequently there is less change in viscosity. In some types of service, however, one must think beyond the mere physical changes that may occur in an oil when exposed to high temperatures, namely, oxidation and the difficulties that may result from it.

Oxidation of petroleum oils may occur to a varied degree, according to the intensity of the oxidizing conditions and the degree of refinement of the lubricant. In a straight mineral oil, refinement leads to the removal of unstable hydrocarbon components which would tend to break down to gummy or tarry residues; in a grease, it involves, in addition, the care with which compounding has been done, along with the purity of the fatty ingredients and their stability or resistance to decomposition. Oxidizing conditions include high temperatures, the presence of moisture and air, and agitation. Normally they work together to cause failure in a lubricant; furthermore, they must always be considered, for their control is limited.

As vaporization or loss of the lighter or more highly volatile components of a hydrocarbon mineral oil progresses, the residual lubricant becomes heavier in body. It will, therefore, be more resistant to circulation or handling in the lubricating sys-

tem. Under continued exposure to abnormally high temperatures, carbonaceous residues may develop; the latter, however, are not necessarily the result of oxidation, although they may very easily combine with oxidized residues to form gummy deposits which may seriously affect the circulation of the remaining lubricant or the functioning of certain machine parts, as, for example, the piston-rings in an air compressor.

### *The Importance of Considering the Carbon Residue in a Lubricant*

For this reason, many authorities feel it best to regard loss by vaporization, and consequently the flash point, as of secondary importance, giving prior consideration to the nature and amount of carbon residue which may be formed and the resistance to oxidation and subsequent development of gummy matter. In other words, they go on the premise that some oil will be lost by vaporization at high temperatures; hence they expect to have to add "make-up"; but meanwhile they realize the importance of keeping their lubricating system as clean and free from deposits as possible. For example, they would use carefully refined, medium viscosity oils of especially low Conradson carbon content for air compressor cylinder service. It is obvious, therefore, that the operating temperature has a decided influence upon the performance of any lubricant. Extremes of temperature call for specially refined lubricants, just as do extremes of speed and pressure.

In low-temperature service, one of the most interesting studies has dealt with the refinement of lubricants for service in air-conditioning and household refrigeration machinery. Here the research chemist has had to study maintenance of lubrication at sub-zero temperatures, along with the possibility of chemical reaction with, or physical solution in, the refrigerants used. All the while he has had to guard against oxidation or chemical breakdown and sludge formation.

Operation under continued high temperatures necessitates consideration of the heat resisting properties of all lubricants employed. High temperatures may be either induced as a result of the expenditure of electrical energy, caused by friction between the contact parts or the lubricants employed, or transmitted to the moving parts from the product being handled. Any oil or grease, when exposed to varying temperatures, will become reduced in body or viscosity as the temperature is increased. For this reason, knowledge of the operating temperature is always necessary.

In this connection, it is important to understand thoroughly the course that the lubricant must follow in service. Lubrication can be broadly classified as internal or external, according to the design of the lubricated machine or device. Cylinder lubrication of any type of reciprocating engine, pump, or compressor is generally regarded as internal; whereas lubrication of engine or lineshaft bearings, gearing, chains, or wire rope is termed external, even though the lubricant must ultimately find its way to enclosed mechanisms. Diesel, automotive, and airplane engines present typical examples of cylinder lubrication where high internal temperatures must be met by the lubricating oil and where severe duty may be involved.

Lubrication by means of straight mineral or slightly compounded petroleum oils requires careful study of change in viscosity; obviously, this change depends upon the range of operating temperatures. Knowing this range and the normal viscosity of the product at any two standard temperatures, such as 100 degrees F. and 210 degrees F., for example, one can read the probable viscosity at the operating temperature directly from the viscosity temperature curve.

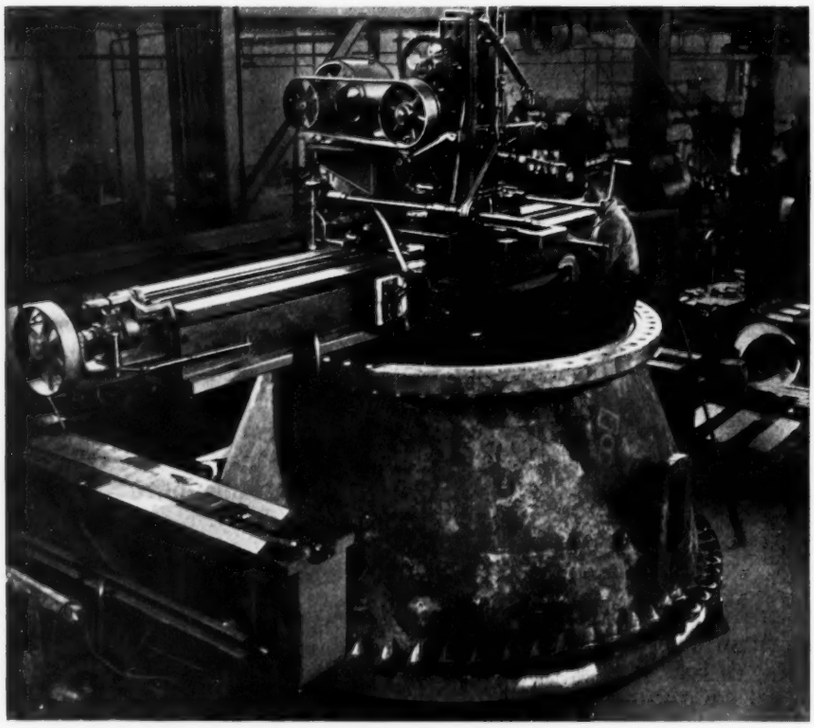
Sometimes there is only a temporary change in viscosity; often, however, there will also be a permanent change in viscosity in certain types of petroleum oils when they are exposed for any length of time to high temperatures. This change is due to partial breakdown and vaporization of the more volatile components which have comparatively low boiling points. The necessity for improvement in methods of refining to remove these components in the process of manufacture has definitely placed the resultant finished products in the classification of special heavy-duty lubricants.

### *Direct and Reaction Pressures must Both be Considered*

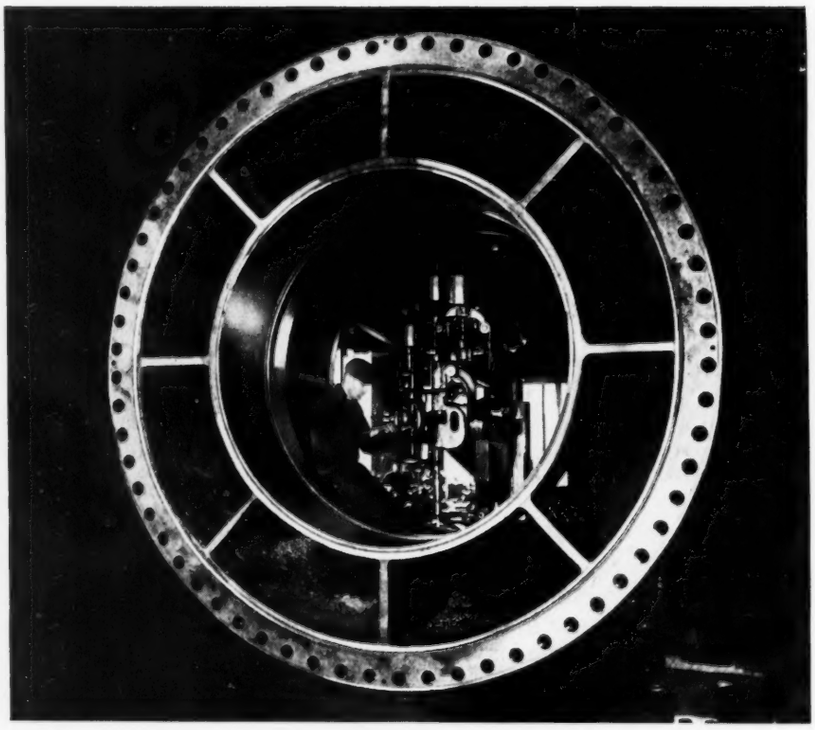
In studying pressure conditions as they may exist in certain types of machinery, it is often necessary to consider not only the effects of direct pressure, but also reaction pressure. By the latter is meant the pressure that may react upon certain of the moving parts as a result of impact pressure. Reaction pressure may be quite severe in press or hammer operation, or in some types of metal-cutting machinery where shock loads must be absorbed. Under normal conditions, this combination of operating pressures will have the most pronounced effect upon the maintenance of a lubricating film. Idling rarely causes any severe load; but when a machine starts to operate and the dies or hammers are applied to the materials to be formed, a series of very heavy pressures will be developed upon many of the gears and bearings.

Mention has been made of the characteristics most essential in lubricants to withstand these pressures. The means of application is of equal importance, however, for frequently it is practicable to combat pressure with pressure by maintaining a constant pressure on the lubricant at its source. Marked progress has been made in developing this type of lubrication in the steel industry, where bearings are large, costly, and subjected to extreme load. More recently the same idea has been applied to the lubrication of gear teeth, both in steel and paper mill service.

# Machining Valves Weighing Sixty

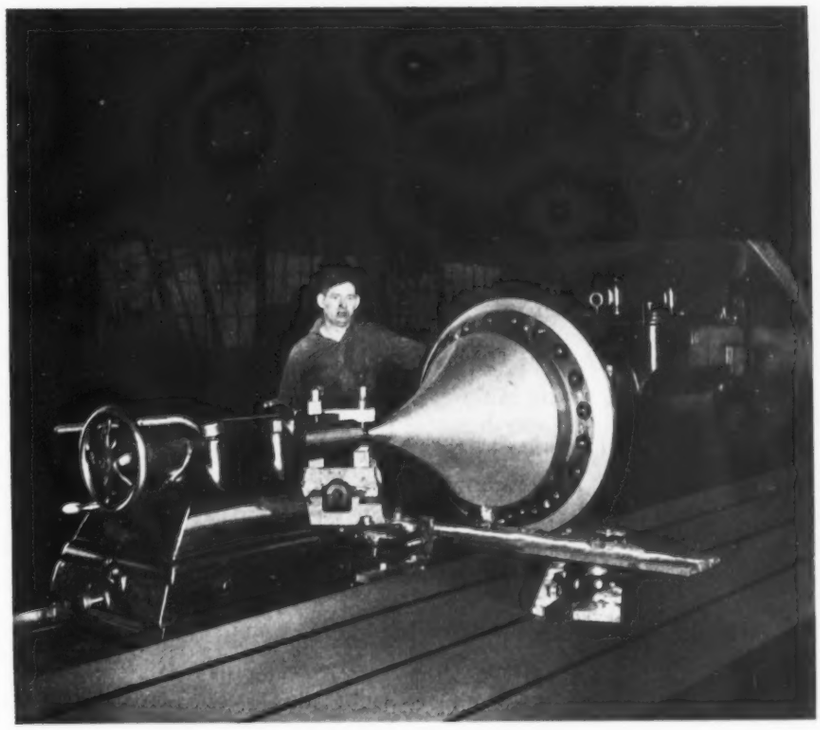


*Slotting a Keyway in One Part of the Valve Housing of One of Twelve Giant Needle Valves for Boulder Dam that were Recently Built in the Plant of the Thomas Spacing Machine Co., Pittsburgh, Pa. This Part of the Housing Weighs Close to 15 Tons*

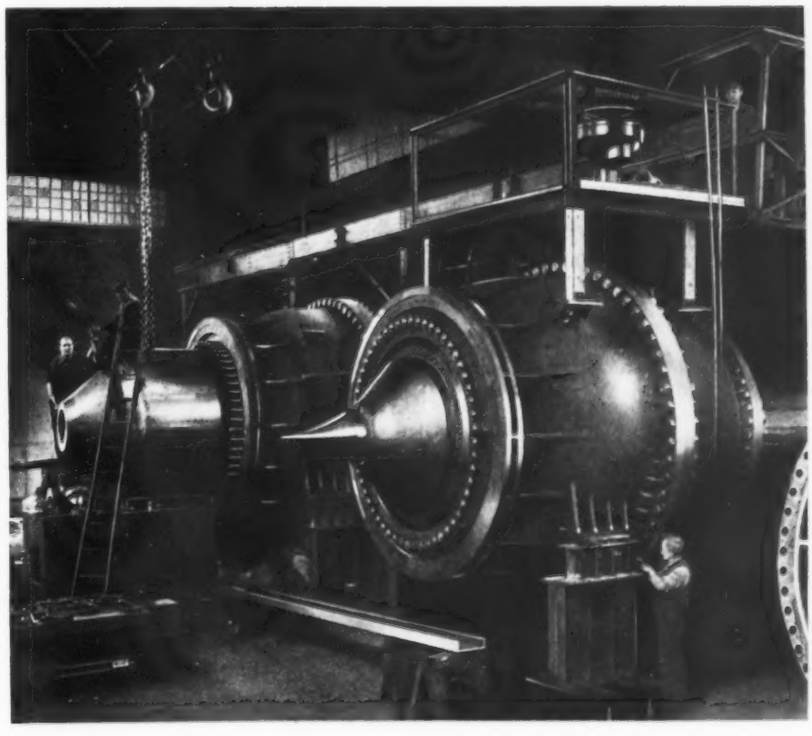


*One of the Many Drilling Operations in Machining the 35,000-pound Valve Housing for the Needle Valves. The Sixty-four 2 7/8-inch Holes in the Outside Flange of the Valve Housing are Drilled by the Use of a Jig 11 1/2 Feet in Diameter*

# Tons Apiece for the Boulder Dam



*Machining the Cast-steel Cone, which is a Part of the Needle Body of the Giant Boulder Dam Needle Valves. A Special Fixture was Designed, as Shown to the Right in the Foreground, to Automatically Control the Proper Curvature of the Tool Motion in Machining*



*Two of the Twelve 72-inch Needle Valves Assembled. The Valve to the Right is Complete, as it will Appear when Ready for Installation at the Dam Site. Each Valve is Assembled for Final Testing before Shipping. The Weight of Each Valve is 120,000 Pounds*

# Engineering News Flashes

## *The World Over*

### Radio-Active Salts Used to Preserve Fire Hose

Radio-active salts are finding unexpected uses. Patents have just been granted to the Manhattan Rubber Mfg. Division of Raybestos-Manhattan, Inc., Passaic, N. J., covering radio-active treatment of fire hose. This treatment is applied to the cotton fabric used in the making of fire hose, which is processed with rare earth metal salts having radio-active properties. The treatment makes the hose permanently resist mildew and makes it moisture-repellent and freeze-proof, thus materially lengthening its life.

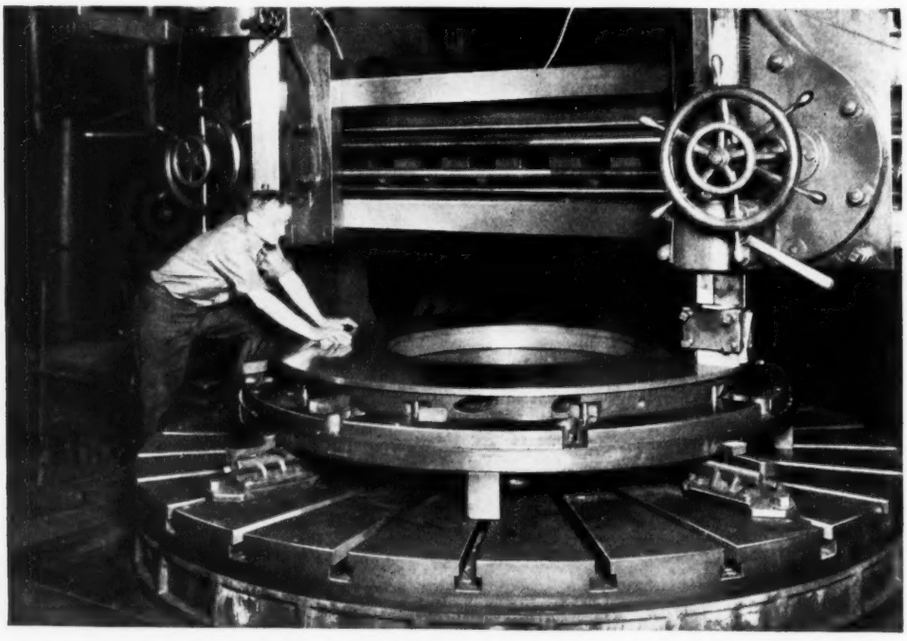
### Largest High-Pressure Power Unit

A new 110,000-kilowatt turbine-generator built by the General Electric Co. has recently been placed in service in the River Rouge power plant of the Ford Motor Co. The new unit is the first large turbine-generator in the world to operate at 1200 pounds pressure and 900 degrees F. With this additional power generating capacity, the Ford power plant becomes the largest industrial high-pressure steam generating installation in the world, having an output of 325,000 kilowatts and rivaling some of the larger public utility plants.

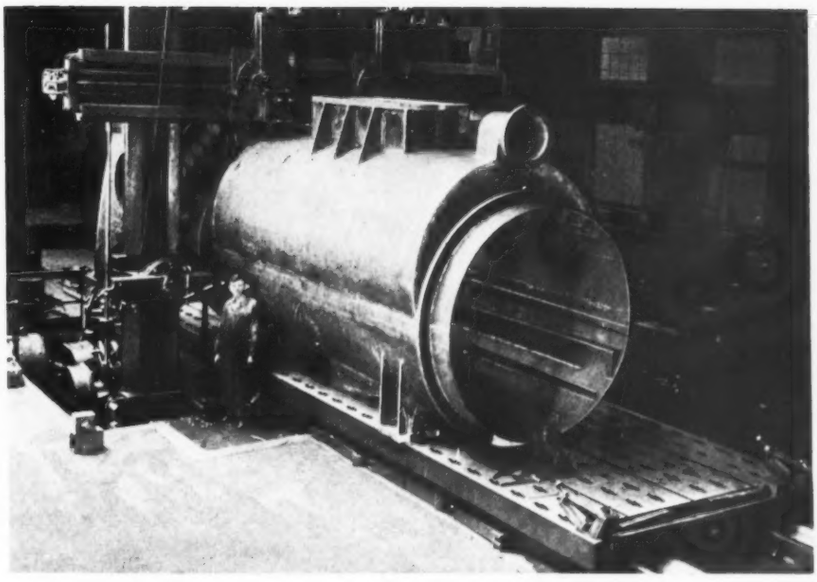
Designed for the Ford plant, where floor space is at a premium, one of the important features of the new equipment is the small amount of space it requires. The total floor space covered is 66 by 25 feet, while the height is 23 feet over all from the floor. The approximate weight is 1000 tons. So compact is the unit that it occupies less than a cubic foot of space per kilowatt of output. Less than a pound of coal is needed to generate a kilowatt-hour of electricity. This is also the first 1200-pound pressure turbine built that does not require the steam to be reheated as it passes from the high- into the low-pressure stages.

### Remarkable Hard-Facing Results

The longest life yet reported for hard-faced valve seat inserts is 350,000 miles. This statement is made on the basis of the experience of a bus transportation company that writes: "We have never been able to wear out a Stellited seat." Another report from Ohio is to the effect that a truck with Stellited valve seat inserts traveled 100,000 miles without a valve grinding job.



*An operation on a ground and hand-lapped 75-inch diameter, 4 1/2-inch thick runner plate for a Kingsbury thrust bearing for one of the new Norris Dam generators. It is lapped to within a tolerance of 0.0005 inch in the plant of the Westinghouse Electric & Mfg. Co. at East Pittsburgh.*



*A 7000 square foot welded-steel surface condenser shell set up for the first machining operation in the Allis-Chalmers Mfg. Co's. shops at Milwaukee, Wis. This shell weighs 10 tons and is 18 feet long. It is mounted on the 30-foot table of a 12-foot planer.*

## World's Largest Continuous Electric Furnace

The Ford Motor Co., Dearborn, Mich., has purchased from the Westinghouse Electric & Mfg. Co. a controlled-atmosphere continuous roller hearth furnace for bright-normalizing automobile body stock in a continuous strand or strip. This furnace is 325 feet long and its output will be 7 1/2 tons an hour, based on a strip 56 inches wide. It is said to be the largest continuous electric furnace in the world. The Ford Motor Co. already has a furnace of this type 227 feet long, which has been in operation for about a year.

By normalizing the strip continuously, it can be delivered to the automobile body plant in a coil and thus fed continuously into the forming presses. The furnace, provided with a first-heating chamber and a reheating chamber, heats the strip in the first chamber to approximately 1750 degrees F. It can be cooled to 800 degrees F. in the first cooling chamber. The reheating chamber is designed to heat the strip from 800 degrees F. to 1300 degrees F. The cooling chamber that follows can cool the strip down to 250 degrees F. before it is exposed to the air.

## Steam-Electric Locomotive for the Union Pacific

Another forward step in modern railroading will be taken early next year, with the appearance of a new steam-electric locomotive being built by the General Electric Co. at Erie, Pa., for the Union Pacific Railroad. This new passenger engine will carry a condensing steam-turbine generating plant feeding electric power to traction motors. Radically different in design from any locomotive now in service, it will eliminate two of the distinguishing characteristics of steam locomotive practice—the side-rod drive and the water tower. The turbine will be of the condensing type, using the same water over and over, with small additions to make up for leakage. The new locomotive will be rated at 5000 horsepower. It will haul 1000-ton trains, like the Los Angeles Limited, over the Los Angeles-Omaha route. Streamlined and practically smokeless, the new locomotive will have a speed of 110 miles an hour on level track.

## A "Permanent" Electric Fuse

An unusual type of electric fuse, known as the "Perma-Fuse," has been developed by the Perma-Fuse Corporation, Louisville, Ky. This fuse makes use of the expansion of mercury when heated, the mercury being used as the current conductor. When a short circuit or overload occurs, the heat generated expands the mercury and breaks the circuit. To restore the fuse to its original condition, all that is necessary is to unscrew the plug and swing it, contact end down. This action returns the mercury to the two contact points within the fuse, and it is then ready for renewed use.

## New Enamels Protect Iron and Steel from Corrosion

A new type of air-drying enamels, especially designed to prevent the corrosion of iron and steel in the railroad, marine, mining, oil, and industrial fields, has been developed by Maas & Waldstein Co., Newark, N. J. These new anti-corrosive enamels are made of rust-inhibiting pigments and a synthetic resin vehicle which form a hard, tough coating, resistant both to wear and to the effect of weather conditions. Exposure tests indicate that they give protection against humidity, salt water, and alkalies, and also prevent electrolytic action.

# How Important is the Cutting Oil in Tapping?

By H. GOLDBERG
Vice-President
R. G. Haskins Co.
Chicago, Ill.

**Observations Covering a Number of Years in the Tapping of Millions of Nuts Have Definitely Established that the Cutting Oil is One of the Most Important Elements in Economical High-Speed Tapping**

THE qualities of the coolant or cutting oil used in tapping are of the greatest importance in obtaining satisfactory results. This has been established through years of careful study in the tapping of many millions of nuts on a special machine designed to test the cutting qualities of taps and cutting oils. The oil used appears to be the most important factor in preventing tap loading. In experiments made with two taps as nearly identical as possible, the most varying results were obtained simply by changing the oil. In one instance, the tap produced less than 50 properly threaded nuts before it was so loaded that it could not be used any longer; by simply changing the oil, the tap life was maintained for 150,000 nuts.

At first glance it would seem well-nigh impossible that two cutting oils could be responsible for such variations. Yet repeated experiments have proved it to be true. With an unsuitable oil, the nuts drop off the machine so hot that they cannot be held in the hand, while with a satisfactory oil there is little increase in temperature. With one oil, there is a puff of smoke every time a nut is tapped. With the other, there is no smoke whatever. No doubt these variations are due to the chemical composition of the oils. Strange as it may seem, it is not always the high-priced oil that is best for tapping; sometimes a lower-priced oil has better cutting qualities, lasts longer, and holds the size of the tapped hole to closer tolerances. In general, however, good tapping oils command a price commensurate with their quality.

### *Tapping Troubles are as Likely to be Due to the Oil as to the Tap*

Many of the tapping difficulties blamed on the tap are due to the cutting lubricant used. Recently, several oil companies have given serious consideration to cutting lubricants. Yet there is little data that is conclusive on suitable cutting oils for tapping. Some shops use soluble oils, others lard oil, and still others various combinations. Possibly the lack of definite information on the subject of tapping lubricants is the reason why industry as a whole has been tapping at slow speeds, whereas all other metal-cutting operations are now done at very high speeds.

No one oil can be expected to be efficient and economical for all metal-cutting operations; nor is any one oil suitable for all tapping operations. Oils satisfactory for tapping brass and aluminum are not suitable for tapping nickel steel or stainless steel. This does not mean that it is necessary to carry a large number of different cutting oils in stock, but it does mean that several grades are required for tapping different kinds of materials.

The greatest single problem in selecting tapping oils is to obtain oils that will prevent tap loading. They must also be able to keep the work cool. Soluble oil will do the latter, but it will not prevent tap loading. It is suitable, however, for certain classes of work, such as alloy cast iron and brass.

It seems that the ideal oil is one that has the cooling characteristics of a soluble oil combined with a sulphur base which has the capacity to keep the tap from picking up metal. Tapping oils should not be judged by their viscosity or body. Heavy oil is suitable only for slow speeds. The higher the speed, the lower the viscosity of the oil must be.

### *Cutting Oil Must be Changed Regularly and Must be Kept Clean*

Many cutting oils may work satisfactorily for a brief period and then seem to lose their life; the longer the oil is used, the poorer the quality of the threads. This is particularly true of some of the sulphur-base oils, which indicates that they ought to be changed at regular intervals. The cleanliness of the machine is also a factor. There is always a certain amount of foreign matter, dust, dirt, and grit that contaminates the oil when it is used continuously. It must therefore be changed frequently, the same as the oil in the crankcase of an automobile.

Many machines from the date of their installation never had the oil tank thoroughly cleaned. Oil is merely added as it is consumed. It is not enough to drain out the old oil and put in a fresh supply. The container should be thoroughly cleaned so that the new oil does not become contaminated.

The oil companies are not to blame for some of the unsatisfactory results obtained with tapping lubricants. Too many manufacturers do not give the oil problem serious consideration, but buy cutting oils on a price rather than a quality basis. The price of a cutting oil per gallon is a comparatively unimportant cost item when distributed over the number of holes tapped. It is possible that the most expensive oil may be the very cheapest for a certain tapping operation. Oil costs less than taps, in any event, and an oil that permits an increase in speed and production, coupled with long tap life, is the cheapest in the long run.

### *Tapping Efficiency May be Greatly Increased*

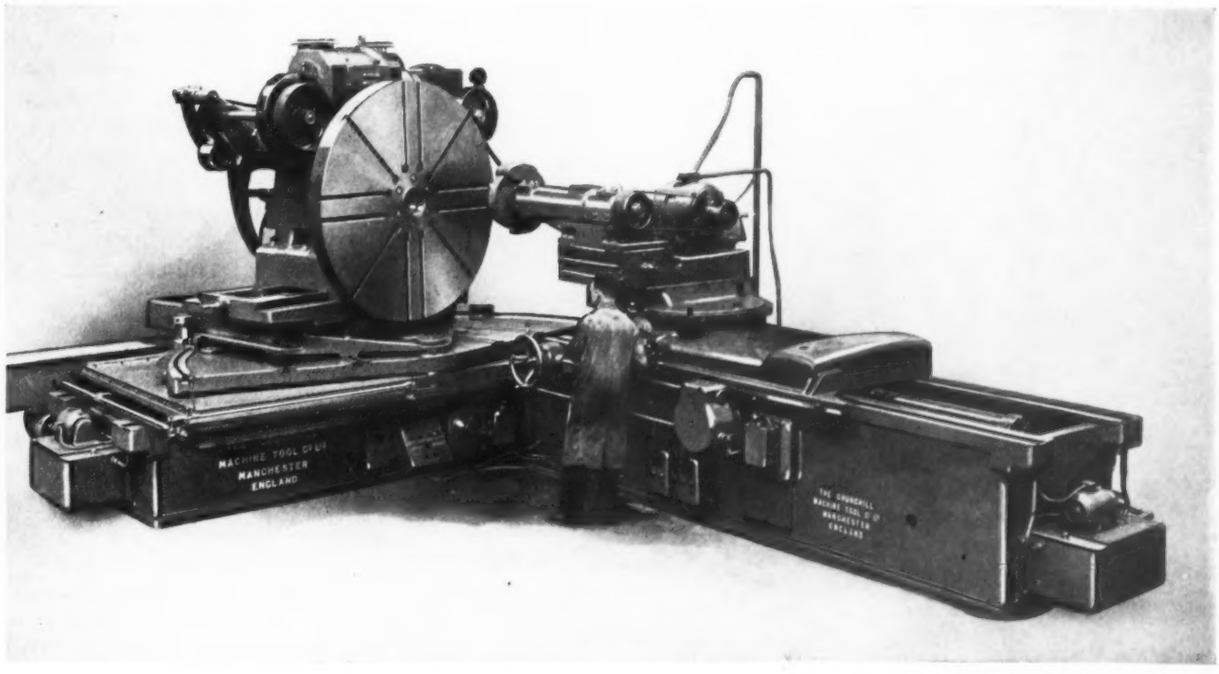
The writer's experiments prompt him to say that industry as a whole does not obtain more than about 10 per cent of the useful life of the taps used. Few taps actually wear out. In most cases, taps load and pick up metal and then break. Most of this breakage is due to using an unsuitable cutting oil. With carefully selected cutting lubricants, this waste of taps can be largely eliminated. For this reason, the importance of experimenting before deciding upon a cutting lubricant for tapping cannot be stressed too strongly.

The manner in which the oil is applied is also of importance. It is not enough to have a stream of oil running on the tap. In horizontal tapping, for instance, the oil must be applied to the work horizontally rather than vertically, so that it will fill the hole being tapped and assist in washing away the chips. There must also be a sufficient volume of oil for high-speed work.

With the cooperation now offered by some of the oil companies, it is likely that the problem of suitable cutting oils for different kinds of high-speed tapping will be solved to the satisfaction of industry. In time, a few oils will doubtless be developed that will be suitable for almost any tapping job, and it may become possible to specify in advance the characteristics and composition of the oil required for any particular tapping problem.

# A Grinding Machine of Huge Proportions

A UNIVERSAL grinding machine of huge proportions was recently constructed by the Churchill Machine Tool Co., Ltd., of Manchester, England, in collaboration with British Timken, Ltd., of Birmingham, for use in the works of the latter company. It has a capacity for grinding both parallel and taper work up to 7 feet in diameter and 30 feet long. Special means may be provided for grinding even larger diameters. Spherical and curved surfaces, as well as flat surfaces, such as are met with in ball-race manufacture, can also be ground. Seven electric motors actuate the various motions of the machine, these motors varying from 35 to 1/2 horsepower. The machine weighs about 45 tons.




A Universal Grinding Machine with Capacity for Work 7 Feet in Diameter and 30 Feet Long

# The Hone is Now Used

**Honing Used to be Considered Practical Only for Holes Greater in Length than in Diameter—This Process is Now Being Applied Successfully to Many Parts of Narrow Width**

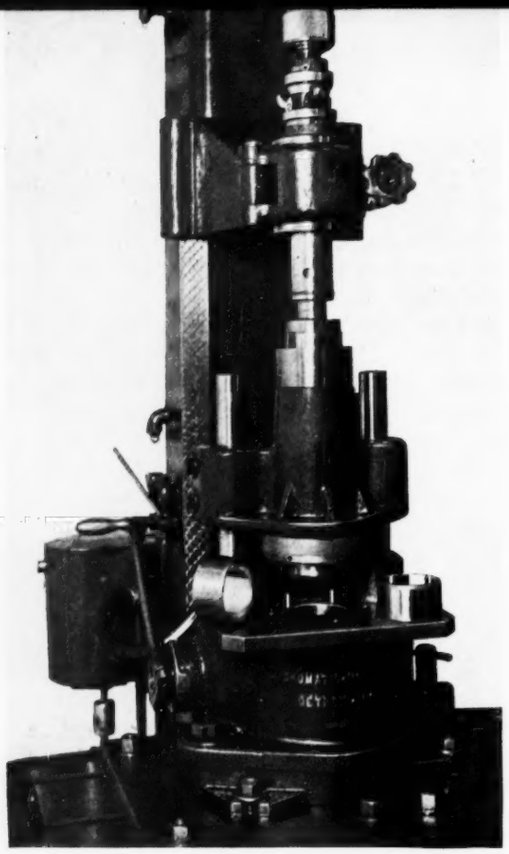
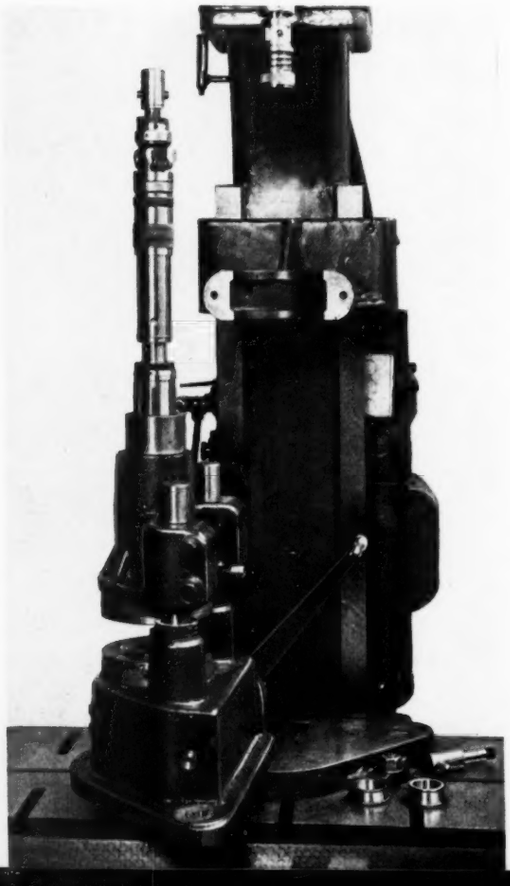


*Fig. 1. Roller-bearing Races 2.8145 Inches in Diameter by Only 1 3/4 Inches in Length are Honed to a Mirror-like Finish in 20 Seconds Floor-to-floor Time*

*Fig. 2. Honing Fixture which can be Swung Forward to Facilitate Removal of the Hone and Replacement of the Abrasive-stone Assemblies*



ONE of the important developments during recent years in the use of the hone for obtaining a high finish in holes has been its application to narrow work. The universal adoption of the hone as a tool for finishing the bores of automobile cylinder blocks, which are considerably greater in length than in diameter, naturally led to experiments on a wide variety of parts. In the field of narrow work, one of the first practical applications was the finishing of the crankshaft end of connecting-rods. This operation is performed, however, with several connecting-rods placed above each other in a fixture, so that actually a long continuous hole is honed.

### *Narrow Roller Bearings Honed One at a Time*

The hone is now being applied successfully for the individual finishing of narrow parts. This method, as well as multiple honing, is employed at the plant of the Bower Roller Bearing Co., Detroit, Mich., with honing equipment supplied by the Micromatic Hone Corporation of the same city. Bearing races of several diameters up to 2.8145 inches are honed to a mirror finish and to size within plus or minus 0.0002 inch, and straight within the same tolerance. Fig. 1 shows a typical operation. The honing machines used in this plant were built by the Barnes Drill Co., Rockford, Ill.

Before the roller-bearing races come to the honing operation, they are carefully ground on the end faces on a Blanchard surface grinder to insure that the bores will be square with the ends when finished. Accurate grinding of the faces is essential to straight honing, because in the latter operation, the part is located from one of these faces. After the face-grinding operation, the circumference of races such as seen in Fig. 1 is ground in a Cincinnati centerless grinding machine, and then the hole is ground in a Heald internal grinder. From 0.0004 to 0.0005 inch of stock on a side is left for removal by honing.

Races 2.8145 inches inside diameter by 1 3/4 inches long are honed with the set-up shown in Fig. 1. Each race is slipped across the table into contact with two vertical pins for approximate lo-

# to Finish Narrow Work

**The Honing Process has Proved Suitable for Accurately Finishing the Races of Roller Bearings. Operations on Such Parts, as well as on Refrigerator Parts, are Here Described**

cation. Then the overhead fixture unit is lowered by operating the handle on the left-hand side of the fixture base. This brings a floating adapter on the overhead unit down on top of the bearing race and clamps it firmly on the flat table.

The hone used in this operation is of a fully automatic type with a pilot located above the abrasive stones, as may be seen at the left in Fig. 5. This pilot is accurately guided in a sleeve in the overhead fixture unit to insure a straight axial motion of the hone with respect to the bearing race as it is held in the fixture. As the pilot is above the abrasive stones, it is always free from grit and coolant. Besides, this location enables it to be made larger in diameter than if it were below the honing stones.

Although the roller-bearing races are made of hardened steel, they are honed at the rate of 20 seconds apiece, floor-to-floor time, or 180 pieces an hour. Six stones, each 2 inches long, are used in the hone. These stones are changed every 275 pieces.

In order to facilitate the changing of hones, the fixture is so arranged that it can be swung forward, as illustrated in Fig. 2, after the upper end of the honing tool has been disconnected from the machine spindle. This enables the honing tools to be changed without withdrawing the machine spindle.

The equipment shown in Fig. 3 is similar to that illustrated in Fig. 1, except that it is intended for the internal honing of races that have an outer tapered surface. With this equipment, however, the race is seated on a floating adapter in the base of the fixture and clamped by a fixed ring on the overhead fixture unit.

### *Honing Narrow Races in Multiple*

Equipment supplied for honing surfaces 1.6875 inches in diameter and only 3/8 inch long in roller bearing races is shown in Fig. 4. These races are so narrow that it would be difficult to avoid bell-mouthed surfaces if they were honed individually, and so equipment was designed for finishing nine races at a time. The nine races are placed on an arbor *A*, and a holder *B* is slipped over them. This holder consists simply of a cylinder of spring steel,

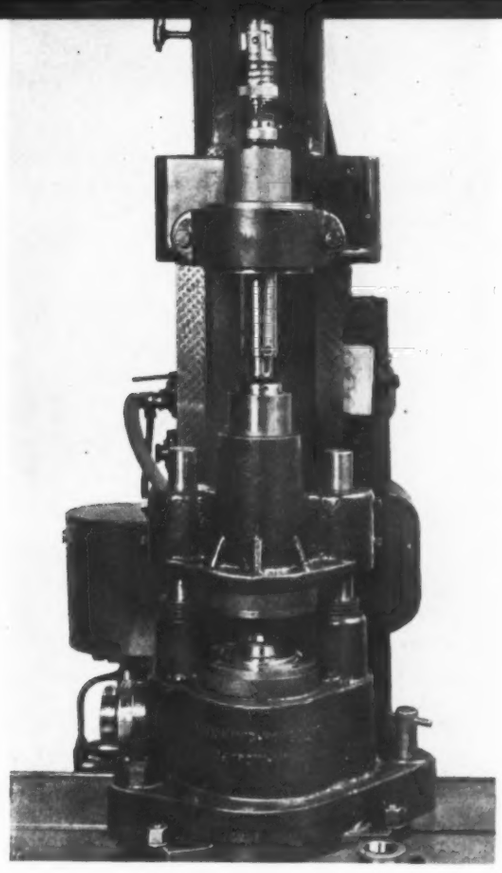


*Fig. 3. Honing Fixture in which the Bearing Seats on a Floating Holder in the Base, whereas in Fig. 1 the Floating Holder is Attached to the Overhead Fixture Unit*

*Fig. 4. Nine Roller-bearing Races that are Exceptionally Narrow are Honed as One Piece by the Use of a Special Work-holder*

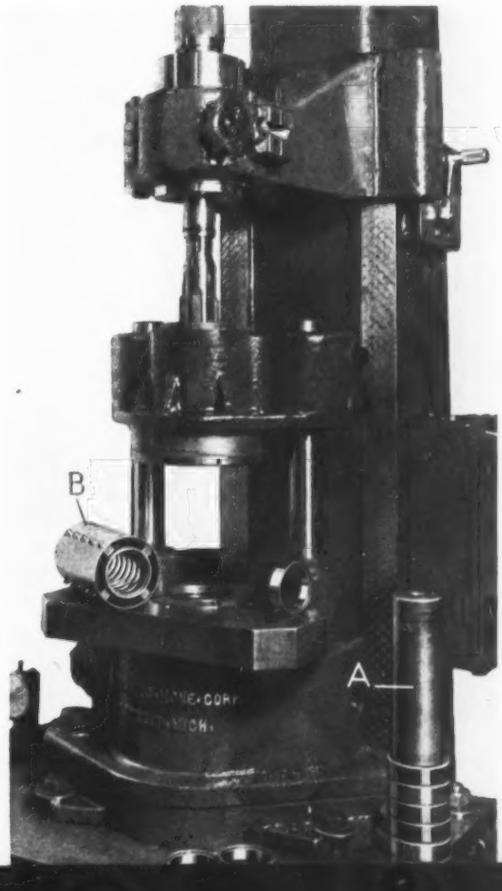


*Fig. 5. Automatic Rear Piloted Hones Designed for Finishing Holes in Work of Narrow Width. The Hone at the Right is Intended for Use in Blind Holes*

fitted on the inside with four long blocks that are adjusted to fit the outside of the races.

The length of the holder is slightly shorter than the combined length of the nine races, so that the upper race projects slightly when the loaded holder is placed in the machine. Thus, when the overhead fixture unit is brought down, the bearings are solidly clamped together on an adapter in the base of the fixture. By observing the loaded workholder in Fig. 4, it will be obvious that the hone must pass over a series of annular grooves in the operation, due to the fact that the honed surfaces of the bearings are somewhat narrower than the full width of the races.

From 0.0007 to 0.001 inch of stock on a side is honed from these races in finishing them to size and straight within 0.0002 inch. The honing time for each load of nine races is 32 seconds. About 1700 races are honed per set of stones. The success of this operation led to several others, in which five somewhat wider races are honed at a time.

### *Honing Cylinders that Have a Lengthwise Slot*

The hone has also been applied by the electrical refrigerator industry for the finishing of small parts. An especially interesting operation in one plant consists of honing a cast-iron cylinder that has a slot 1/4 inch wide running the full length. The cylinder bore is 2 1/2 inches in diameter by 1 3/8 inches long. The slot must be machined before the part is honed; otherwise, distortion would occur as stresses in the cylinder wall were released while the slot was being machined.

Difficulties have been experienced in the past in attempting to hone slotted parts, due to the sharp corners of the slot tending to shear the abrasive stones as they passed over them. However, operations of this sort are now being successfully performed by the use of abrasive stones that are wide enough for the rear side to provide a substantial support on the wall being honed, as the front edge of the stone bridges the slot.

The slotted refrigerator cylinders are being honed to size within plus or minus 0.0002 inch and within an average of 0.0001 inch for roundness and taper. The bores are finished over size 0.0001 inch for a width of 3/8 inch on each side of the slot. About 0.0004 inch of stock on a side is removed by honing, the cylinder having been previously bored with a tungsten-carbide tool. The floor-to-floor time in honing is only 25 seconds, and approximately 600 pieces are honed with each set of stones.

The operation is performed with the general type of equipment shown in Fig. 1, except that a rear piloted hone suitable for short holes is used. Such a hone is illustrated at the right in Fig. 5. Hones of this type have also been successfully applied in finishing holes with blind or closed ends. Rejected work in the cylinder honing operation is less than 3 per cent of the total production.

In the same electrical refrigerator plant a cast-iron bushing 1 5/16 inches long with a hole 1 3/16 inches in diameter is honed to size within plus or minus 0.0001 inch, in 15 seconds floor-to-floor time. This part is also previously bored with a tungsten-carbide tool which leaves about 0.001 inch of stock on the diameter to be removed by honing. The operation is also performed with equipment of the same general type as illustrated in Fig. 1. Since the hone was adopted for finishing these bushings, rejected work has been reduced to less than one-half of 1 per cent.

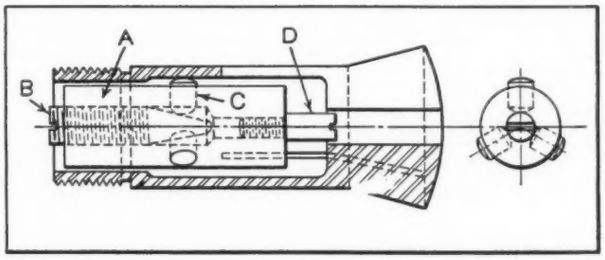
* * *

## Adequate Lighting Aids Production

At a recent meeting of industrial lighting specialists held at Nela Park, Cleveland, Ohio, W. A. D. Evans, president of the General Electric Vapor Lamp Co., said: "Industry at last is becoming light conscious, but that is only the first step in giving to lighting its proper recognition as a production tool. Our next step is to create a consciousness of the need to choose the individual 'lighting tool' best suited to each type of work. Enough light, in itself, does not necessarily create good seeing conditions. Distribution of the light to avoid glare and objectionable shadows, its color characteristics and ability to provide a comfortable visual effect, as well as the justifiable cost for such lighting, are all factors requiring guidance on the part of the industrial lighting specialist, equipped with a knowledge of all the 'tools' available."

# Ideas for the Shop and Drafting-Room

**Time- and Labor-Saving Devices and Methods that Have been Found Useful by Men Engaged in Machine Design and Shop Work**




Collet Equipped with Work-locating Stop

## Stop for Draw-Back Collet

The simple collet stop here illustrated was devised for use on a bench lathe to facilitate turning a shoulder on some cold-rolled steel pins. This stop simplified the setting-up work and saved considerable time, as it permitted the shoulders to be turned to the desired length without the use of a gage. The device is inexpensive, consisting simply of the body *A*, the tapered screw *B*, locking pins *C*, and the removable stop *D*.

Richmond Hill, N. Y. PHIL. E. VERAA

## Low-Cost Method of Making Temporary Cams

In the manufacture of special machines that require numerous cams, considerable expense is often incurred before cams of the required shapes are evolved. Much of this expense results from the slow machining process employed in machining the steel cams. In order to reduce this cost as much as possible, the method described in the following was developed:

First, a core for the experimental cam is made of steel to fit the shaft upon which the cam is required to operate. This steel core, or adapter, is then set in the center of a circular enclosure and a lead-tin-antimony alloy, such as Matrix metal, is poured into the space between the arbor and the enclosure. When the material has cooled, the cam profile is machined in the regular way. The greater facility with which the softer material can be machined reduces the cost of the completed cam.

The cam made in this manner is given a light copper plate, upon which is deposited a thin coat of chromium. On short runs these cams stand up very well. If it is necessary to change the contour of one of these cams, it is stripped, the required corrections are made, and then it is replated.

When a cam is thus made to the required shape, it can be employed as a master cam in cutting other cams of the same shape. Cams made recently by the method described were used on a screw machine for a medium run and found to be highly satisfactory. The only change made was to substitute brass for the softer alloy material, because it seemed likely that the pressures involved might cause the softer metal to break down. The chromium-plated brass cams stood up well for the entire run of parts, and are still in good shape. This method is adapted for peripheral cams, face cams, and in some cases for barrel cams.

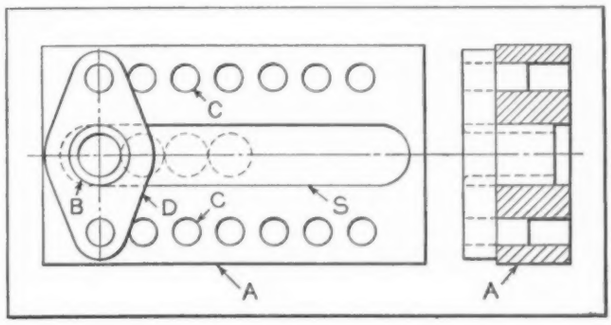
New York City JOHN A. HONEGGER

## Slot-Drilling Jig Plate

The jig plate shown in the accompanying illustration is used for drilling a row of holes close together. The same principle can be used when the holes are required to break into each other. With this device, the drilling is done in the ordinary way by simply moving the bushing-holder *D* from hole to hole. There are no movable stops, and the jig does not need to be turned over.

Only the plate *A* and holder *D* are shown, as the design of the rest of the jig depends on the shape of the work. The plate *A* has a slot *S* in it, which is wide enough to take a standard bushing *B*. Stop-pin holes *C* are drilled at each side of the plate. As these holes are smaller than the drilled holes in the work, there is plenty of stock between them, even though the drilled holes break into each other.

Hamilton, Ont., Canada F. MUIR




Jig Plate for Use in Drilling Closely Spaced Holes

# EDITORIAL COMMENT

## Excessive Taxation Puts the Brakes on Industrial Progress

Is it generally appreciated that governmental expenses—federal, state, and local—at the present time amount approximately to one-third of the national income? What does this mean? First of all, it means that all of this expense must be collected by taxation—either now or later. The average contribution of every man and woman will be one-third of his or her income. We do not all feel this tax burden directly, because the methods of taxation carefully cover up the taxes we pay. But we think that everything we buy is high in price; much of this rising cost of living is simply the rising cost of government.

The result of industrial development and engineering progress is to constantly reduce the cost of goods and services, thereby *reducing the cost of living* and *raising the living standard.* The effect of increasing governmental expenses is the direct opposite; they *increase the cost of living* and *reduce the living standard.*

There is no problem of greater importance facing all who are engaged in industry today than that of increased governmental expenditures and increased taxation. Here is one of the main obstacles to the well-being of the nation, to steady employment, and to a high standard of living. The reason that this question is dealt with in MACHINERY is because of its great importance to industrial progress—and industrial progress is the chief concern of a mechanical journal.

## How Much Do High Taxes Take Out of the Pay Envelope?

It is important to all engaged in industry, whether as managers or wage earners, that they should pay serious attention to our rising taxes. If every time we paid a bill we knew the approximate amount of taxes included, we would soon become tax conscious. We would learn that we, too, help to pay when the government engages in unnecessary or unwise expenditures.

For every dollar paid in wages by several hundred of the larger manufacturing concerns in the country, 34 cents is paid by the manufacturer in taxes. In other words, every time a machinist receives $30 in his pay envelope, his employer has also to turn over a $10 bill to the tax collector.

Corporations, large and small, could perform a great public service if they would tell facts like this, both to their employes and to their customers. If it were possible to state on every bill of sale how much of the purchase price was attributable to taxes, it would serve the purpose of making the buyer tax conscious. As it is, the great body of voters believe that taxes are paid only by corporations, owners of real estate, and people with large incomes. What we need is a campaign of information to let everybody know how much of the purchase price of everything he buys goes to pay for government spending.

## Improved Machines Deserve Improved Accessories

Improved machine tools can render efficient service only when used in conjunction with modern work-holding devices and up-to-date tools. In some cases, new expensive machine tools are installed—machines capable of greatly increasing production and reducing costs, provided they are given a chance; but all too frequently old chucks, jigs, fixtures, and accessories are merely transferred from the old to the new machines. Under such circumstances, how can the machines render the service expected of them?

All that a modern machine tool can do is to reduce the cutting time. It cannot reduce the set-up time unless the auxiliary equipment is of a character that permits the most rapid handling of the work. If the set-up time on the new machine is the same as on the old, the efficiency of the new equipment during the set-up period is lost. Machines that reduce the actual machining time to one-fifth or less are not unheard of. It is certainly poor economy when installing such equipment not to provide the very latest and best in work- and tool-holding devices, so that the set-up time can be reduced to a minimum, and the idle time of a highly efficient machine be cut down as far as possible.

The same idea applies to tools. The new machine calls for the very best cutting tools available, be it milling cutters, drills, taps, counterbores, or other tools. To get the best results, no one factor can be neglected. It is poor economy to try to save a few dollars on tools and accessories after having spent thousands on machines.

# Ingenious Mechanical Movements

Mechanisms Selected by Experienced Machine Designers as Typical Examples Applicable in the Construction of Automatic Machines and Other Devices

## Long-Stroke Reciprocating Motion for Guiding Wire on Reel

By L. KASPER

The accompanying illustration shows diagrammatically a reciprocating motion mechanism used for guiding wire on a broad reel. The mechanism is designed to give a long stroke, with a uniform rate of traverse speed and a period of rest at each end of the stroke.

Rod *E*, which is supported in bearing *F*, carries two pins *P* at its outer end for guiding the wire. Sprocket *A* drives sprocket *B* through the block chain *C*. The special link *D*, inserted in the chain in place of one of the standard links, carries the rod *E* on the pin *G*. The length of link *D* is such that pin *G* travels along the center line between the two sprockets. Link *D*, in traveling from sprocket to sprocket, transmits a uniform reciprocating motion to rod *E*.

At each end of the stroke, pin *G* remains stationary while the link *D* rotates half way around the sprocket, providing a period of rest which is determined by the diameter of the sprocket. On extremely long strokes, it is necessary to support the chain to avoid excessive sag.

## Reciprocating Devices that Vary Their Points of Reversal

By J. E. FENNO

Gradual variations of one or both reversal points of a reciprocating slide or shaft can be obtained automatically by using the star-wheel mechanism shown in Fig. 1 in combination with a proper intermediate drive, four types of which are illustrated in Fig. 2. Eight different movements can be obtained with the various combinations; and any combination can be instantly converted to obtain a constant point of reversal by simply swinging the pawl to its upper position.

These movements are particularly adapted for mixing, valve-grinding, and textile machinery, where the stroke of a slide or a reciprocating shaft movement must be gradually increased or diminished, or where the positions of both points of reversal of the slide or the shaft must change gradually without changing the distance traveled between these two points.

The star-wheel mechanism consists principally of the arm *A*, Fig. 1, on which is mounted a shaft carrying the star-wheel, together with a worm meshing with the worm-wheel *B*. The worm-wheel

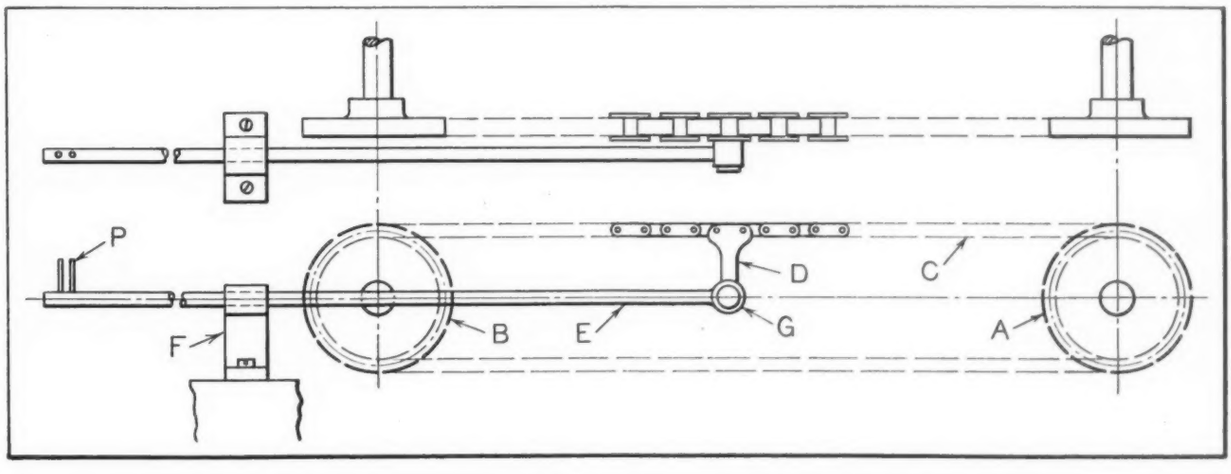



Diagram Showing Arrangement of Chain and Sprockets for Obtaining Reciprocating Motion for Guiding Wire on a Long Reel

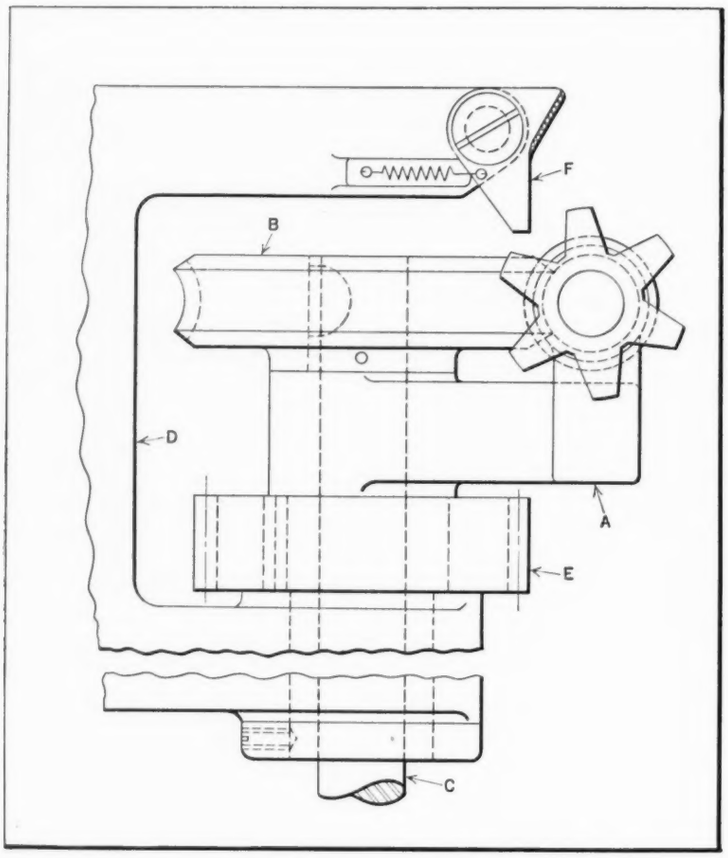



Fig. 1. Device Used with Any One of the Drives in Fig. 2 for Gradually Varying the Reversal Points of a Shaft or Slide

is keyed to the shaft *C*, which has for its bearing a long sleeve, integral with the hub of arm *A*. This sleeve is free to turn in a stationary bearing on the bracket *D*, and has a spur gear *E* keyed to it. The driving member for this mechanism may be either a reciprocating or a continuously rotating gear, depending upon the movement to be transmitted through the intermediate drive; this gear (not shown) meshes with gear *E*.

Suppose that it is required to transmit movement to the slide at *A* in Fig. 2, so that the length of the stroke increases uniformly from zero to the maximum travel, the position of the point of its reversal at the left remaining constant. The cam shown here would be mounted on shaft *C* (Fig. 1), and the driving member for the star-wheel mechanism would be a reciprocating gear or rack. Now, as shaft *C* is locked to the arm by the worm and worm-gear, an oscillating movement is imparted to it by the driving member. However, during each cycle, the oscillating shaft will be advanced or retarded (according to whether the worm has a right- or a left-hand thread) by the action of pawl *F* on the star-wheel.

Assume now that the angular movement of the shaft *C* is 135 degrees, and that the cam is about to rotate in the direction of the arrow (Fig. 2). The cam-roll will follow the concentric portion of the cam groove and the slide will have no movement. During the next oscillating cycle of the cam, the position of both reversing points with respect to the cam will be slightly advanced in a clockwise direction, due to the action of the star-wheel mechanism. This action will cause the roll to pass a short distance into the irregular portion of the cam groove, thus moving the slide a very short distance.

After each oscillation of the cam, the roll enters the irregular groove farther, uniformly increasing the stroke of the slide until it has reached its maximum travel. To prevent the roll from coming into contact with the end of the cam groove and damaging the mechanism, automatic dogs are usually provided on the machine for discontinuing the operation of the star-wheel mechanism; or in some cases, provision is made for automatically returning the cam to its starting position.

It should be noted, however, that owing to the fact that the roll passes over part of the concentric portion of the groove before the slide has reached its maximum travel, the slide will have a dwell at the beginning of each stroke. This dwell will decrease as the stroke increases, until finally, when the slide has reached its maximum travel, the dwell will equal zero.

To gradually vary the time at which the reversal of a slide occurs relative to the movements of the rest of the machine, the position of the reversal points remaining constant, the intermediate drive shown at *B* is used. In this case, the gear in the star-wheel mechanism is rotated continuously by another gear. Thus the angular movement of shaft *C* (Fig. 1) will be uniformly advanced or retarded (depending on whether the worm thread is right- or left-hand) relative to the movements of the rest of the machine members. Consequently, the time at which each reversal of the slide occurs will also be advanced or retarded relative to the movements of the other machine members.

When it is required to change the position of a slide gradually at both points of reversal, the drive shown at *C*, Fig. 2, may be employed. The cam, as before, is keyed to the shaft of the star-wheel mechanism, which, in this case, is driven by a reciprocating gear or rack meshing with gear *E*, Fig. 1. Assume, as in case *A*, that the angular movement of the shaft is 135 degrees. The rise of the cam groove is uniform. Hence, no matter what part of the groove the roll follows, the stroke of the slide will remain constant.

However, owing to the action of the star-wheel mechanism, the cam lags or advances after each cycle (depending upon whether the worm thread is

left- or right-hand). Therefore, although the stroke of the slide remains constant, the positions of both reversal points of the slide change uniformly until the roll approaches the end of the cam groove. To prevent the roll from striking the end of the groove and damaging the mechanism, the same provision is usually made as mentioned for case *A*.

Another type of drive for producing practically the same movement as that just described is shown at *D*, Fig. 2. In this case, a pinion and sliding rack are used instead of the cam and roll. This is perhaps a simpler and more economical design, and it has the advantage of varying the position of the reversal points of the slide over a longer distance than would be practical with the cam type of drive.

To vary both points of reversal of a reciprocating shaft uniformly, no intermediate drive is required, because the shaft on the star-wheel mechanism—when driven by a reciprocating gear or rack—has this movement. All other reciprocating shaft movements corresponding to those of the slides shown in Fig. 2 can be obtained by combining the star-wheel mechanism with the proper intermediate drive and mounting a rack on the slide. The rack, meshing with a gear on the part to be reciprocated, will transmit the required movement.

## Gray Iron Specifications Available

The Gray Iron Founders' Society, Inc., 1010 Public Square Bldg., Cleveland, Ohio, announces that, by arrangement with the American Society for Testing Materials, it has collected and bound in a serviceable booklet, the specifications of that Society affecting the gray iron foundry. This booklet, in addition to the directory of the Gray Iron Founders' Society's membership, is available at cost, so that engineers and purchasing agents can obtain a list showing just which foundries in their neighborhood have these specifications and are prepared to supply castings in accordance with them.

* * *

Directly and indirectly more than 6,000,000 people derive their incomes from occupations created by the automobile industry and connected with the manufacture, merchandizing, or operation of motor vehicles. Of this number considerably more than 400,000 workers are employed directly in motor vehicle and parts factories. The machine, instead of causing unemployment, has created millions of jobs.

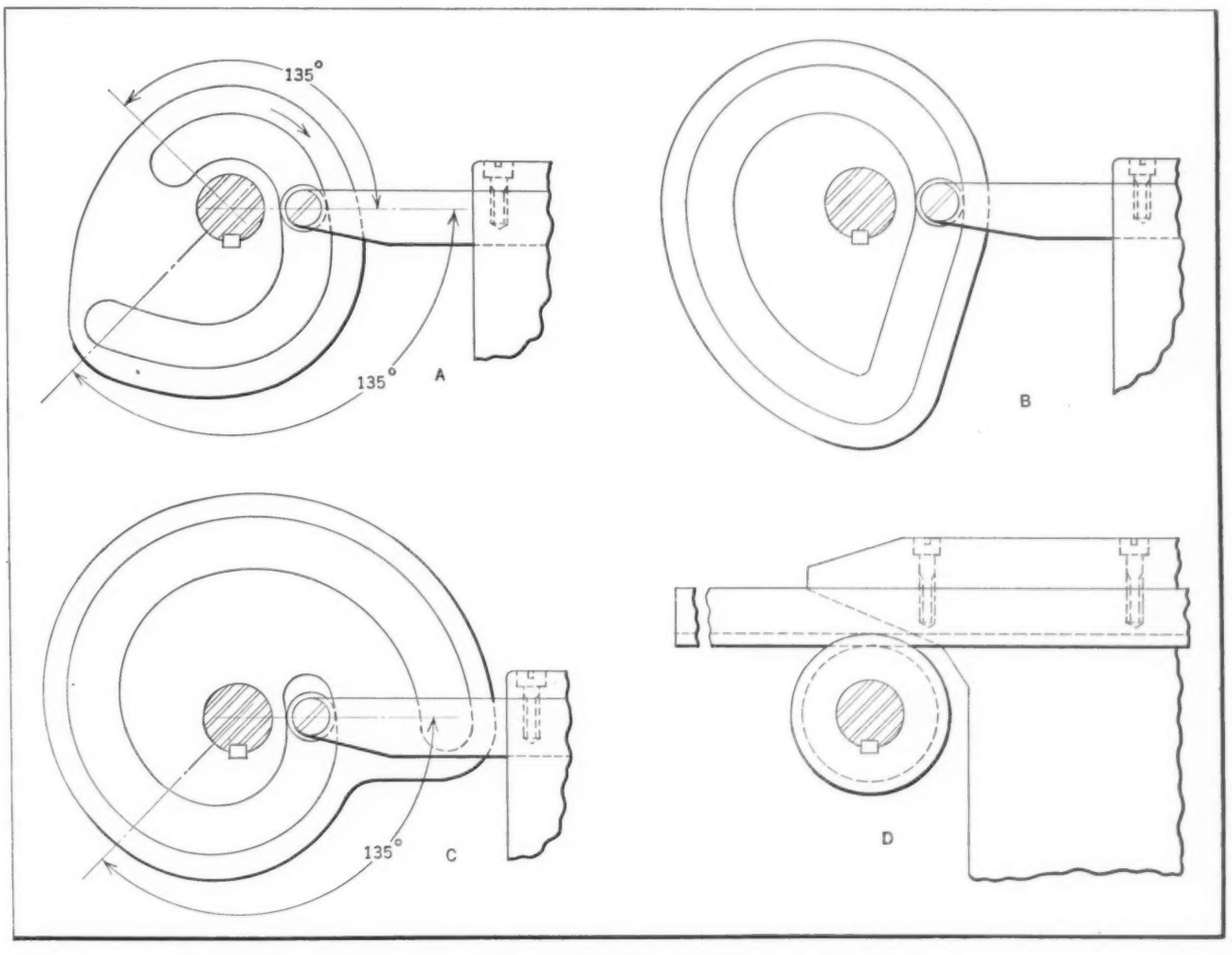
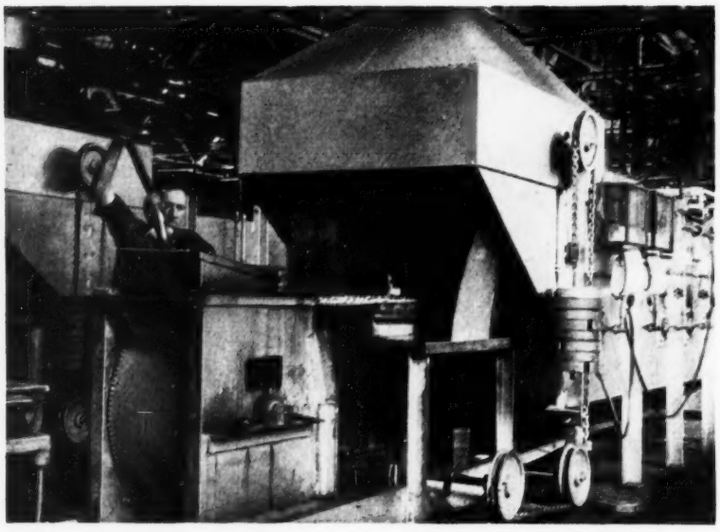



Fig. 2. Intermediate Drives Used with the Device Shown in Fig. 1 for Varying One or Both of the Reversal Points of a Shaft or Slide



# Up-to-Date Heat- at the Chevrolet

**More than One-hundred and Fifty Different Parts for Chevrolet Automobiles are Heat-Treated at One Plant**

*Fig. 1. Charging End of Gas-fired Hardening Furnace*

A LARGE section of a modern industrial building, lighted from four sides and equipped with a variety of gas-fired furnaces, is used by the Chevrolet Motor Co., Bay City, Mich., for heat-treating from 150 to 160 different automobile parts. These parts consist chiefly of screw machine products that must be hardened on a mass production basis. They include cross-shafts, fan-shafts, piston-pins, rocker arms, rocker-arm supports, clutch hubs, valve tappets, push-rods, bolts, spring shackle pins, etc. Practically all of the gas-fired furnaces are mechanically equipped and operated automatically.

One type of furnace, Fig. 1, has a conveyor consisting of a perforated alloy-steel belt running on sprockets having shafts located at each end of the furnace. This closed-loop belt is extended 6 feet beyond the charging end of the furnace to serve as a loading table. The furnace is of the usual firebrick and refractory construction with a steel case, and is 18 feet long. Heat is supplied by fourteen tunnel type gas burners, seven on each side, which underfire the work.

The conveyor is driven by a motor, located on top of the furnace. The heated work drops through the opening in the hearth at the discharge end, falling into an oil quench. The quenching tank is equipped with a flight type conveyor, Fig. 2. The burners, which are provided with venturis for gas-air mixing, are manifolded in two groups. Each group has an automatic temperature controller that actuates a solenoid valve in its respective gas-feed line. There are two of these furnaces and four recording pyrometers. Such parts as connecting-rod bolts are heated for hardening in these furnaces, while a pusher type hardening furnace, Fig. 3, is used for drawing them. Self-dumping trays for carrying the bolts are provided for this work.

The rails on which the trays ride extend beyond both ends of the furnace. The extension at the charging end forms an 8-foot loading table. The motor-driven pusher consists of a number of cams, levers, and dogs located between the rails. These pusher parts rock back and forth, and thus push the work along. The rails extending beyond the discharge end rise at an angle of 30 degrees; this allows the trays to ride out on another set of horizontal rails which have a slightly wider space between them. Only the trunnion extensions at the back of the trays engage this last set of rails, which allows the trays to drop automatically into a hanging position, discharging the work into a quenching bath or into tote-boxes.

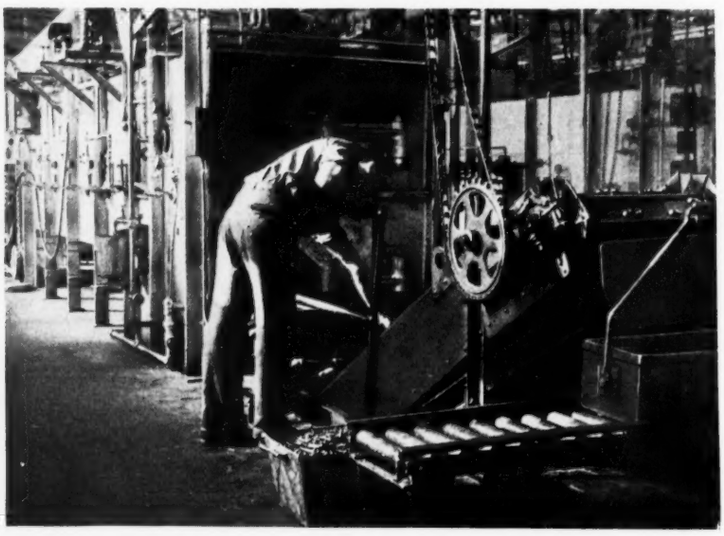


*Fig. 2. Quenching and Discharging End of Furnace Shown in Fig. 1*

# Treating Equipment Plant

By J. B. NEALEY

**in a Variety of Gas-Fired Furnaces Having Automatic Controls and Conveyors Designed to Meet the Requirements**

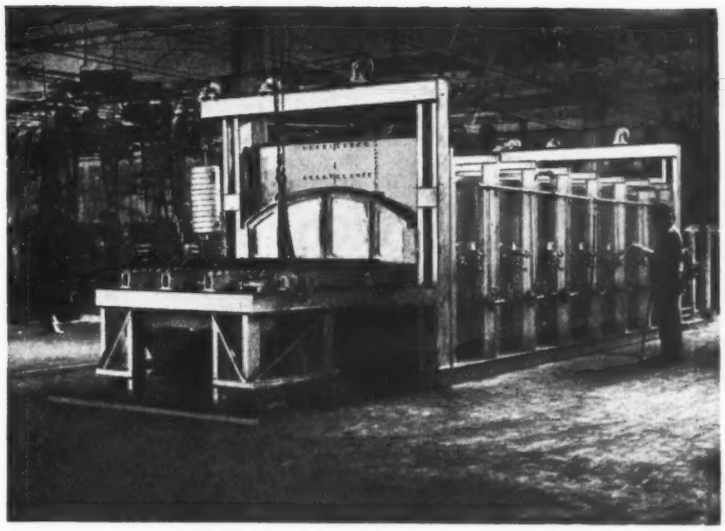


*Fig. 3. Charging End of Pusher Type Gas-fired Furnace*

Each door is opened and closed by a motor. The furnace is 10 feet wide, 5 feet high, and 25 feet long. Heat is supplied by thirty gas burners, fifteen on each side. Of these burners sixteen overfire and fourteen underfire the work. All thirty burners are manifolded in two groups and each group is provided with an automatic temperature control which actuates the motor-operated valves in the two gas feeder lines. Temperature fluctuations are checked by two recording pyrometers.

Skin-hardening or casehardening is accomplished in a group of cyanide furnaces provided wih quenching baths. Some of these furnaces are rectangular in shape, and are 3 feet wide and 5 feet long. Two gas burners of the low-pressure type are used at each end of the furnaces. Gas is reduced to atmospheric pressure in a zero governor and pressure air is employed to inspirate the gas. The automatic temperature control consists of a thermo-couple, a potentiometer, and a motor-operated valve in the air line to the burners. An interesting feature of this system is that no control valve is needed in the gas line, as the air line control valve automatically governs the amount of gas and air supplied to the burners.

A unique set-up consists of two circular cyanide furnaces connected by flues to a preheating device located between them. Baskets of work placed on the preheating device are heated by the waste heat from the furnaces, each of which is equipped with two gas burners of the type described in the preceding paragraph. The quenching baths are held in long rectangular tanks provided with rotating cylinders of perforated sheet steel, set at an angle so that they move the work through and out of the quenching bath.

Rotary retort furnaces are used for carburizing which employ straight natural gas as the carburizing medium. Each of these furnaces is 5 feet long by 4 feet in diameter and is equipped with trunnions, so that it can be set on a stand and tilted to discharge the work. Heat is supplied by sixteen gas burners, eight to a side. Inside the furnace is a work-holding retort rotated by a motor. The work is carburized by the gas forced through this retort.

Parts such as rocker arms are hardened by heating to 1500 degrees F. in lead baths for eight minutes and quenching in water. There are three lead pots for this kind of work, each 4 feet in diameter and 3 feet high, which are heated by four gas burners of the high gas pressure inspirator type. Only one end of each rocker arm is hardened. To

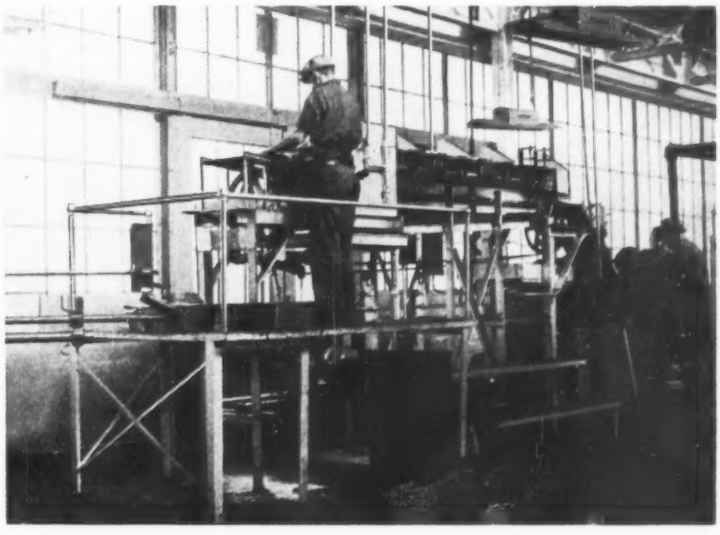


*Fig. 4. Heating Ends of Push-rods in Open-side Furnace*

accomplish this, the rocker arms are strung on spindles and laid across the furnace with the proper ends hanging down in the molten lead.

Heating furnaces of the slot type, shown in Fig. 4, are used to heat push-rods, one end at a time, for forming operations performed in presses. The furnaces used for this work are only 12 inches wide by 18 inches high, but they are 10 feet long and are set on steel frames 6 feet high, so that the hot work can slide by gravity into the presses below.

In front of each furnace is a traveling belt conveyor, on which the stock is so placed that one end travels along in the furnace slot while being heated. The furnace is fired with twelve gas burners located in a row in the back wall. The ball end of the push-rod is formed in three operations in one press, while the socket end is formed in the same number of operations in another press. Four identical furnaces and four presses are used for this work.

Parts such as piston-pins are carburized to a depth of 0.048 inch in furnaces that are arranged to heat the work in a gas atmosphere at 1700 degrees F. for about twelve hours and then cool it in a water-jacketed cooling chamber of the same furnace for twenty minutes, or until it reaches a temperature of 900 degrees F. The time required for this work is 12 1/2 hours. The work is then reheated to 1500 degrees F. for twenty-one minutes in another furnace and quenched in water.

The carburizing furnace is of the full muffle type and is 45 feet long. The cooling chamber occupies 12 feet of this length. The muffle rests on refractory piers and contains rails on which baskets holding the work are pushed through by means of a mechanical pusher. There are forty gas burners, twenty to a side, of which eighteen fire against the roof arch, while the rest underfire the muffle. These burners are manifolded in groups of six and seven on a side, and the manifolds of the corresponding groups on opposite sides are connected to the same fuel service pipe. This divides the furnace longitudinally into three temperature zones. Each of these zones is equipped with a separate automatic temperature controller connected to an on-and-off motor valve in the corresponding gas service line. These valves are by-passed for minimum flame operation.

Air-tight gates at each end of the muffle are operated by pneumatic pistons. A separate unit is employed for re-forming and otherwise processing the gas which is forced into the muffle as a carburizing medium. A central control panel holds four recording pyrometers of the circular chart type, three for the furnace and one for the gas re-forming unit.

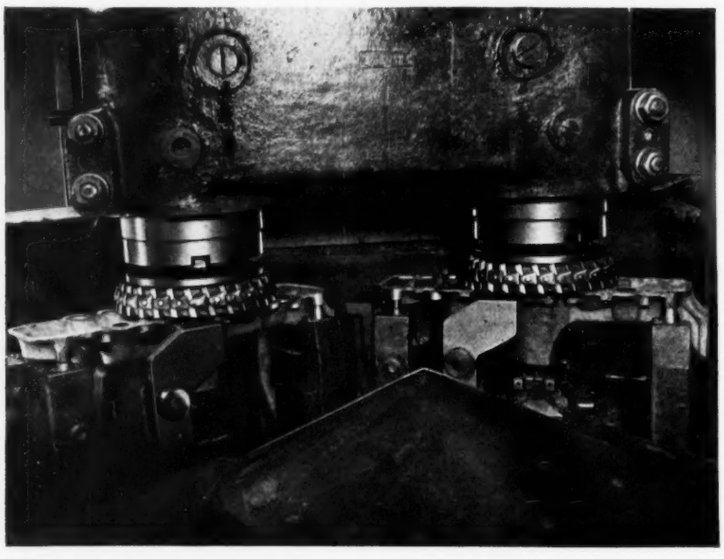
* * *

## Colloidal Graphite for Lamp Bases

Corrosive gases in the air in industrial plants, as well as dampness, will cause corrosion of incandescent lamp bases in their sockets. This can be overcome by applying to the threaded portion of the lamp base, colloidal graphite suspended in water, which not only forms a dry lubricant, but is also an anti-corrosive agent. The surface to be treated, after having been cleaned of grease, can be covered with colloidal graphite simply by spraying or brushing. Lamps and fuse plugs so treated should not be screwed into their sockets until the graphite film is thoroughly dry.

* * *

The record for wear of gear teeth, we presume, is held by a clock having brass works, made by an artisan at the Court of Philip the Good, of Burgundy, in 1439. According to the Copper & Brass Research Association, this clock still keeps good time, provided one is satisfied with its method of recording time—it is made with only one hand, the hour hand.



*Aluminum Valve Chamber Covers are Milled at the Ford Motor Co.'s Plant at a Speed of 85 Inches a Minute by 10-inch Cutters which Run at 525 Revolutions per Minute. Depth of Cut is 0.080 Inch*

## TAP DRILL SIZES FOR NATIONAL STANDARD SCREW THREADS (CLASS 2—FREE FIT)—3

**Practice of the Railway & Industrial Engineering Co., Greensburg, Pa.**

| Tap | | | | Tap Drill† | | Clearance Drill‡ | |
|---|---|---|---|---|---|---|---|
| Size | Threads per Inch | Kind of Thread* | Maximum Diameter, Inches | Size | Diameter, Inches | Size | Diameter, Inches |
| 13/32 | 27 | Special | 0.406 | U | 0.3680 | Z | 0.4130 |
| 7/16 | 14 | Coarse | 0.4375 | U | 0.3680 | 29/64 | 0.4531 |
| | 20 | Fine | | 25/64 | 0.3906 | | |
| | 24 | Special | | X | 0.3970 | | |
| | 27 | Special | | Y | 0.4040 | | |
| 1/2 | 12 | Special | 0.500 | 27/64 | 0.4219 | 33/64 | 0.5156 |
| | 13 | Coarse | | 27/64 | 0.4219 | | |
| | 20 | Fine | | 29/64 | 0.4531 | | |
| | 24 | Special | | 29/64 | 0.4531 | | |
| | 27 | Special | | 15/32 | 0.4687 | | |
| 9/16 | 12 | Coarse | 0.5625 | 31/64 | 0.4844 | 37/64 | 0.5781 |
| | 18 | Fine | | 33/64 | 0.5156 | | |
| | 27 | Special | | 17/32 | 0.5312 | | |
| 5/8 | 11 | Coarse | 0.625 | 17/32 | 0.5312 | 41/64 | 0.6406 |
| | 12 | Special | | 35/64 | 0.5469 | | |
| | 18 | Fine | | 37/64 | 0.5781 | | |
| | 27 | Special | | 19/32 | 0.5938 | | |
| 11/16 | 11 | Coarse | 0.6875 | 19/32 | 0.5938 | 45/64 | 0.7031 |
| | 16 | Fine | | 5/8 | 0.6250 | | |
| 3/4 | 10 | Coarse | 0.750 | 21/32 | 0.6562 | 49/64 | 0.7656 |
| | 12 | Special | | 43/64 | 0.6719 | | |
| | 16 | Fine | | 11/16 | 0.6875 | | |
| | 27 | Special | | 23/32 | 0.7188 | | |
| 13/16 | 10 | Coarse | 0.8125 | 23/32 | 0.7188 | 53/64 | 0.8281 |
| | 12 | Special | | 47/64 | 0.7344 | | |

*Coarse = Coarse Thread Series (Same as U. S. Standard).
Fine = Fine Thread Series (Same as S. A. E. Standard).
Special = Special Thread Series.
†Tap drills give approximately 75 per cent full thread.
‡Clearance drill is minimum standard size for maximum diameter tap.

MACHINERY'S Data Sheet No. 331, New Series, October, 1936

Contributed by John E. Scheibler

## TAP DRILL SIZES FOR NATIONAL STANDARD SCREW THREADS (CLASS 2—FREE FIT)—4

**Practice of the Railway & Industrial Engineering Co., Greensburg, Pa.**

| Tap | | | | Tap Drill† | | Clearance Drill‡ | |
|---|---|---|---|---|---|---|---|
| Size | Threads per Inch | Kind of Thread* | Max. Diam., Inches | Size | Diameter, Inches | Size | Diameter, Inches |
| 7/8 | 9 | Coarse | 0.875 | 49/64 | 0.7656 | 57/64 | 0.8906 |
| | 12 | Special | | 51/64 | 0.7969 | | |
| | 14 | Fine | | 13/16 | 0.8125 | | |
| | 18 | Special | | 53/64 | 0.8281 | | |
| | 27 | Special | | 27/32 | 0.8438 | | |
| 15/16 | 9 | Coarse | 0.9375 | 53/64 | 0.8281 | 61/64 | 0.9531 |
| | 12 | Special | | 55/64 | 0.8594 | | |
| 1 | 8 | Coarse | 1.000 | 7/8 | 0.8750 | 1 1/64 | 1.0156 |
| | 12 | Special | | 59/64 | 0.9219 | | |
| | 14 | Fine | | 15/16 | 0.9375 | | |
| | 27 | Special | | 31/32 | 0.9688 | | |
| 1 1/16 | 8 | Special | 1.0625 | 15/16 | 0.9375 | 1 5/64 | 1.0781 |
| 1 1/8 | 7 | Coarse | 1.125 | 63/64 | 0.9844 | 1 9/64 | 1.1406 |
| | 12 | Fine | | 1 3/64 | 1.0469 | | |
| 1 3/16 | 7 | Special | 1.1875 | 1 3/64 | 1.0469 | 1 13/64 | 1.2031 |
| 1 1/4 | 7 | Coarse | 1.250 | 1 7/64 | 1.1094 | 1 17/64 | 1.2656 |
| | 12 | Fine | | 1 11/64 | 1.1719 | | |
| 1 5/16 | 7 | Special | 1.3125 | 1 11/64 | 1.1719 | 1 21/64 | 1.3281 |
| 1 3/8 | 6 | Coarse | 1.375 | 1 7/32 | 1.2188 | 1 25/64 | 1.3906 |
| | 12 | Fine | | 1 19/64 | 1.2969 | | |
| 1 1/2 | 6 | Coarse | 1.500 | 1 11/32 | 1.3438 | 1 33/64 | 1.5156 |
| | 12 | Fine | | 1 27/64 | 1.4219 | | |
| 1 5/8 | 5 1/2 | Coarse | 1.625 | 1 29/64 | 1.4531 | 1 41/64 | 1.6406 |
| 1 3/4 | 5 | Coarse | 1.750 | 1 9/16 | 1.5625 | 1 49/64 | 1.7656 |
| 1 7/8 | 5 | Coarse | 1.875 | 1 11/16 | 1.6875 | 1 57/64 | 1.8906 |
| 2 | 4 1/2 | Coarse | 2.000 | 1 25/32 | 1.7813 | 2 1/64 | 2.0156 |

*Coarse = Coarse Thread Series (Same as U. S. Standard).
Fine = Fine Thread Series (Same as S. A. E. Standard).
Special = Special Thread Series.
†Tap drills give approximately 75 per cent full thread.
‡Clearance drill is minimum standard size for maximum diameter tap.

MACHINERY'S Data Sheet No. 332, New Series, October, 1936

Contributed by John E. Scheibler

# Questions and Answers

**A Department in which the Readers of MACHINERY are Given an Opportunity to Exchange Information on Questions Pertaining to the Machine Industries**

## Machines Using Elliptical Gears

A. H. S.—Are there any machines being built at the present time that employ in their design gears of elliptical shape?

This question is submitted to MACHINERY'S readers. The information wanted is simply the name and purpose of the machine using elliptical gears; the approximate size of these gears; and the name and address of the firm building these machines.

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## Salesman Leaving to Go with Competitor

R. E. D.—We have had considerable difficulty with salesmen to whom we have advanced drawing accounts. Frequently when a salesman gets in the red, he leaves us and takes employment with a competitor, and then goes out and sells the prospects he had called on for us. Is there any way by which we can protect ourselves against this practice?

Answered by Leo T. Parker, Attorney-at-Law
Cincinnati, Ohio

Various Courts have held that a contract which is valid and enforceable may be made between a salesman and his employer, by the terms of which the salesman agrees not to take employment with a competitor in a specified territory within a reasonable time after leaving the present employment. Also, it is important to know that recently a higher Court upheld this type of contract, made *after* the salesman had been with his employer for several months.

In Roessler v. Burwell [176 Atl. 126], reported in February, 1935, a salesman, who had been working on a weekly salary without any written contract was required by his employer to make a written employment contract. This contract stated that the employe desired to continue in the employment, and that the employer agreed to employ the salesman indefinitely, and that, in the event the employer should discharge or discontinue the services of the salesman for any cause whatsoever, the salesman would not for a period of one year after severing his connection with the employer call upon "or directly or indirectly in any capacity solicit the same business from any of the customers" whom he had called upon during his employment. The contract also specified that should the salesman violate the agreement, the employer would be entitled to an injunction to restrain the salesman from soliciting any of such customers.

Several months later the salesman quit the employment and began to solicit orders from the former employer's customers, whose names and places of business he had learned during his employment. The former employer immediately filed suit against the salesman for an injunction to restrain him from soliciting business from these customers. The higher Court promptly granted the injunction and said:

"The defendant (salesman) was in no way restricted from entering into the same business anywhere he chose, nor in taking any proper means to build up such a business and secure customers, so long as he did not attempt to take away from the plaintiff his own customers."

The higher Courts have held contracts of this nature valid provided (1) that the area of territory specified is no greater than that in which the salesman works; (2) that the time specified is not more than two years; and (3) that the contract restrains the salesman from selling only such products as he is now selling for the employer.

* * *

## Problems of the Machine Designer

In an article in the *Student Branch Bulletin* of the American Society of Mechanical Engineers, George F. Nordenholt points out that one of the most important jobs of the engineer is the selection of the type of construction to be used and the materials of construction. These two questions are inter-related. The decision as to the first largely limits the second. For example, if a die-cast construction is decided upon, the materials of construction are immediately limited to those alloys that can be die-cast—the zinc-base, the aluminum-base, and the copper alloys. The possibility of using a die-cast construction may immediately suggest a molded construction, using one of the great variety of synthetic plastics. A large number of factors enter into the problem, such as the size and shape of the part, the finish required, the weight, the character of attached members, fastening methods, etc. No definite rule can be given to follow; experience and judgment must be the chief guides.

# One Die-Casting Replaces Several Stampings

**A Description of Dies that Produce a Typewriter Ribbon Spool Having a Threaded Steel Insert**

By CHARLES O. HERB

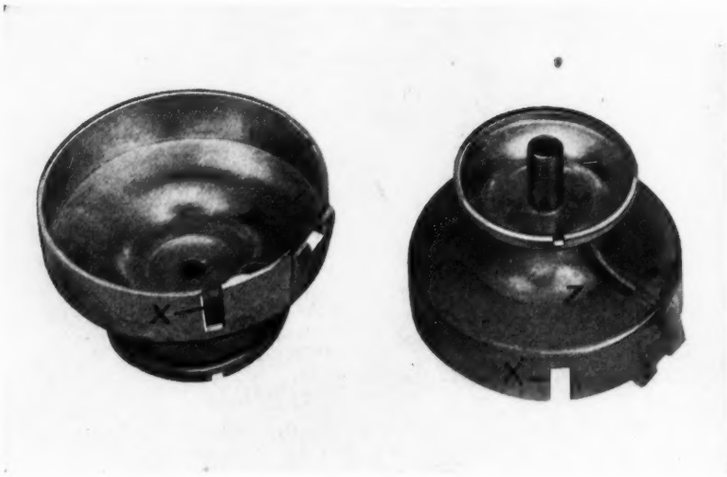


*Fig. 1. Zinc Die-Casting with a Threaded Steel Tube which has Replaced a Part Formerly Made of Several Stampings*

THE die-casting process has received the greatest application in the manufacture of zinc, aluminum, and lead parts that were formerly cast in sand molds. However, parts that consist of one or more steel stampings can often be replaced with die-castings to considerable advantage. Fig. 1 shows a die-cast ribbon spool, made entirely of zinc except for a threaded steel tube which is cast in place. This spool was formerly made of several stampings which required a number of power press operations and, in addition, several assembly operations.

The die-cast spools are made two at a time in one operation by means of the automatic dies illustrated in Figs. 2 and 3. These dies were produced by the Madison-Kipp Corporation, Madison, Wis., for use on the automatic die-casting machines built by that concern. In Fig. 2, the movable die is seen at the left and the stationary member at the right.

### *Sliding Cores Necessary to Permit Ejection of the Final Pieces*

Moving cores are required for these parts because of their circular surfaces. Thus, the interior of the large end of each spool is formed by a core *A*, Fig. 3, which is attached to a sliding holder *B*. When the movable die is in contact with the stationary member in operation, an angular pin *C* fixed to the stationary die engages a hole in each slide *B*. As the movable die is withdrawn from the stationary member at the end of an operation, each holder *B* is moved vertically about 1 1/4 inches as it slides off pin *C*. This vertical movement is sufficient to bring the lower end of core *A* clear of the casting. The holders *B* are held in the raised position by spring detents *E*. They are fastened to the face of the movable die by housings *D*.

The opposite end of each ribbon spool is formed by a core *F*, which is attached to a holder *H*. This core is lowered by means of an angle-pin *J* when the movable die is withdrawn from the stationary member. The angle-pin method of operating cores is extensively used by the Madison-Kipp Corporation when the core movement is comparatively short, say not more than 2 inches.

### *Inserting the Threaded Tube in the Dies*

In Fig. 3, the threaded steel tubes are shown at *W* as they are positioned in cores *F* for the casting operation. The tubes are inserted when the movable die is withdrawn from the stationary die at the end of each operation.

From Fig. 1 it will be seen that the spools are cast with a slot *X* in the large flange, a slot *Y* in the small flange, and a rectangular hole *Z* in the body portion. Slot *X* is produced by a core *J* which is shown in section *A–A*, while opening *Z* is produced by core *K*. Slot *Y* is formed by core *L* in section *B–B*.

Standard means are employed for ejecting the finished pieces from the movable die—that is, long slender pins attached to plate *M*. These pins extend through the die parts to the cavities, in which the ribbon spools are cast. Plate *M* is stopped near the end of the movable die stroke as rods *N* come in contact with a fixed member of the machine. This causes the die members to slide along the stationary ejector-pins fastened to plate *M*, so that the pins force the castings from the die. Coil springs around the outer ends of rods *N* return plate *M* to the casting position as the movable die is again closed against the stationary die.

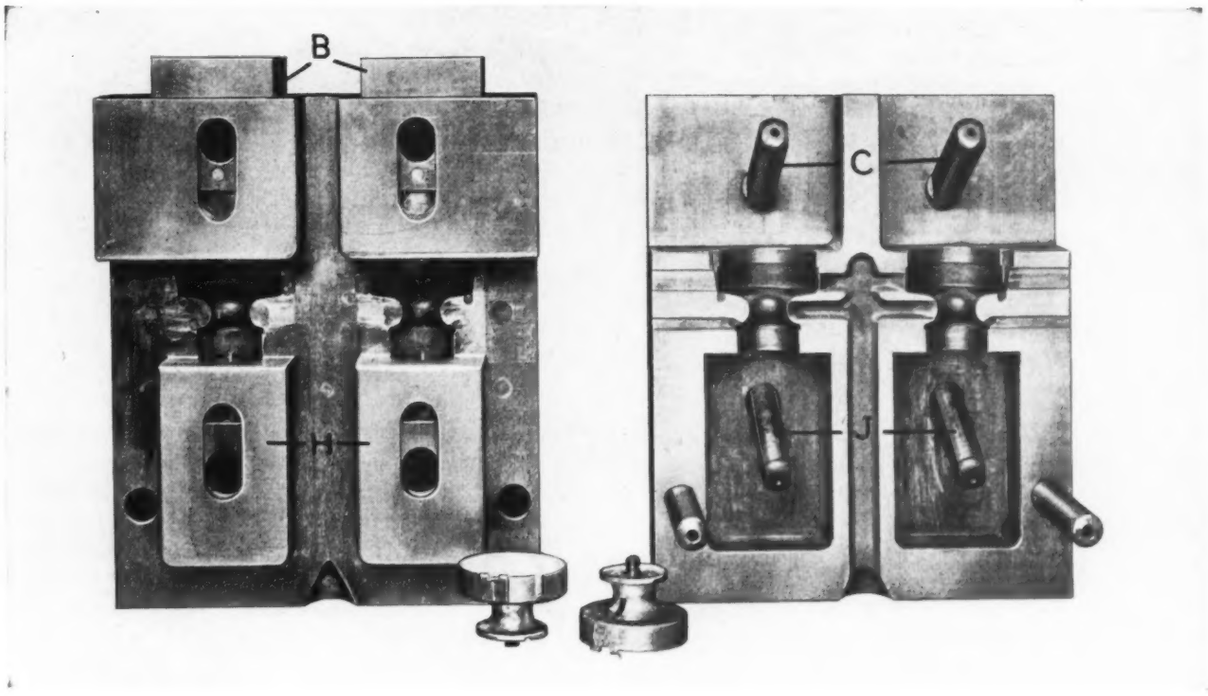
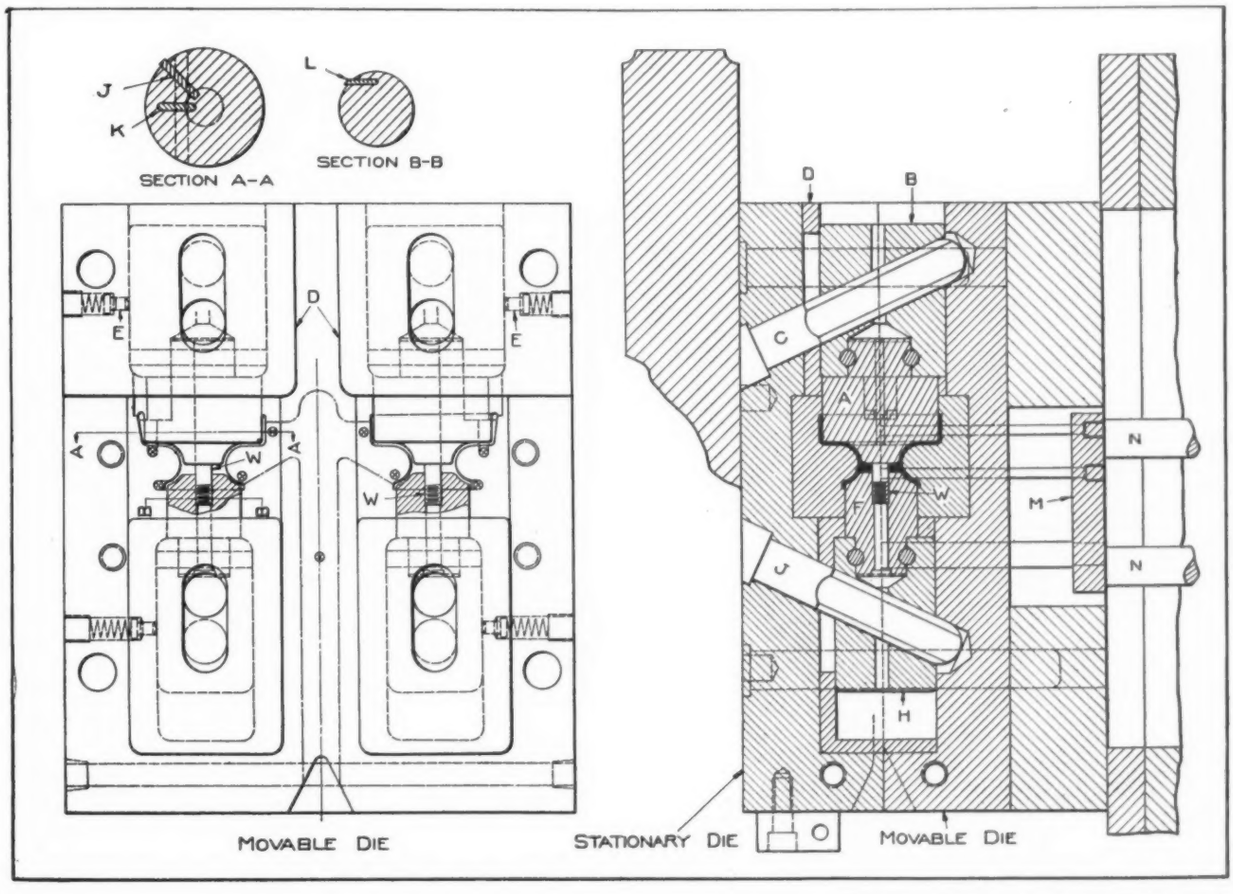



*Fig. 2. (Above) Dies which Produce Two Zinc Typewriter Ribbon Spools Complete with Threaded Steel Inserts in One Operation*

*Fig. 3. (Below) Four Cores Moved Vertically by Angle-pins are a Feature of These Dies which Produce the Typewriter Ribbon Spool Shown in Fig. 1*



The ejector-pins do not actually come in contact with the spool castings. Instead, the dies are so made as to permit the formation of small "ears" at several points around the castings, and it is against these ears that the ejector-pins act. The ears are afterward trimmed off, so that with this arrangement there are no marks of the ejector-pins on the finished castings. In the left-hand view of Fig. 3, the ejector-pins are indicated by small crosses. One of the ejector-pins bears against the metal cast in the gate that carries molten metal to the two cavities.

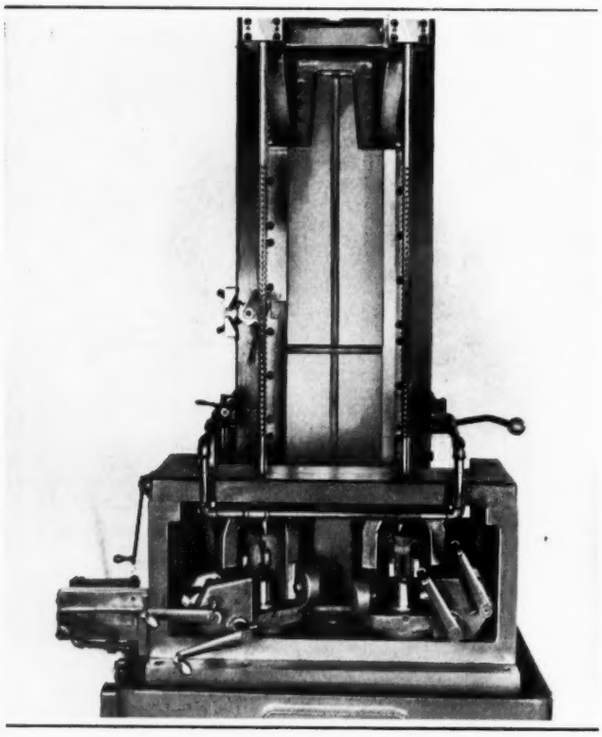
From four to five shots can be made a minute with these dies. Based on an hour of only 50 minutes, this means a production between 400 and 500 pieces an hour. The life of the dies should be long enough to permit a total production of at least 1,000,000 pieces.

# Machining Round Holes with Spline Broaches

THE Colonial Broach Co., Detroit, Mich., recently had the problem of providing equipment for broaching a round hole 1 1/4 inches in diameter through a piece 4 inches long, the requirement being that the hole be to size and straight within 0.002 inch. To obtain this accuracy (starting with a cored rough hole), it was decided to use a broach that would cut six splines to the required diameter in one pass through the work, then index the work 30 degrees, and again pass the broach through the work to remove the stock remaining between the splines that were formed with the first pass of the broach.

The machine, fixtures, and broaches used for this operation are shown in the accompanying illustration. Two fixtures and broaches provide for completely finishing one piece with each ram movement. Bushings are provided above and below the work-pieces to prevent deflection of the slender broaches when they are in operation.

After each broach has made its first pass through the work, it is drawn back through the spline that it has cut. On the return stroke, a block on the left-hand side of the ram trips a device that actuates a valve for admitting air into a cylinder on the left-hand end of the fixture. The piston in this cylinder causes the two fixtures to index automatically, one for the first broaching cut and the other for the second. The work-pieces, which are not illustrated, are small malleable-iron castings. They are broached at an average rate of 180 right- and left-hand pieces an hour.



Long Slender Spline Broaches Produce Round Holes in Two Passes through Malleable-iron Castings

* * *

## Air-Conditioning of Railroad Cars Develops into a Large Industry

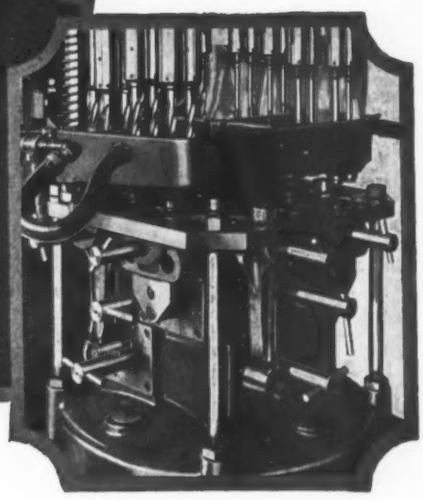
Since 1932, the railroads have spent considerably more than $50,000,000 to air-condition approximately 6000 passenger cars. This is equivalent to the amount spent for air-conditioning for all other purposes during the same period, according to L. W. Wallace, director of equipment research of the Association of American Railroads. Through their progressiveness in adopting air-conditioned equipment, the railroads have done a great deal to make railroad traveling attractive in the summer. Railroad traveling on a hot day used to be an ordeal; today an air-conditioned train is one of the most comfortable places to be in on a warm day.

* * *

## Annual Industrial Packaging Competition

The All-American Package Competition for 1936, sponsored by *Modern Packaging* to show the progress made by American industry in packaging and displaying its products, will be conducted this year as usual, with the competition closing on December 19. The awards will be announced in March, 1937, concurrently with the Seventh Annual Packaging Conference, to be held in New York City. Judging from past years, thousands of entries will probably be placed before the judges.

# Design of Tools and Fixtures



## Fixture Clamp with Auxiliary Work-Locating and Clamping Member

By FRANK SERRAL

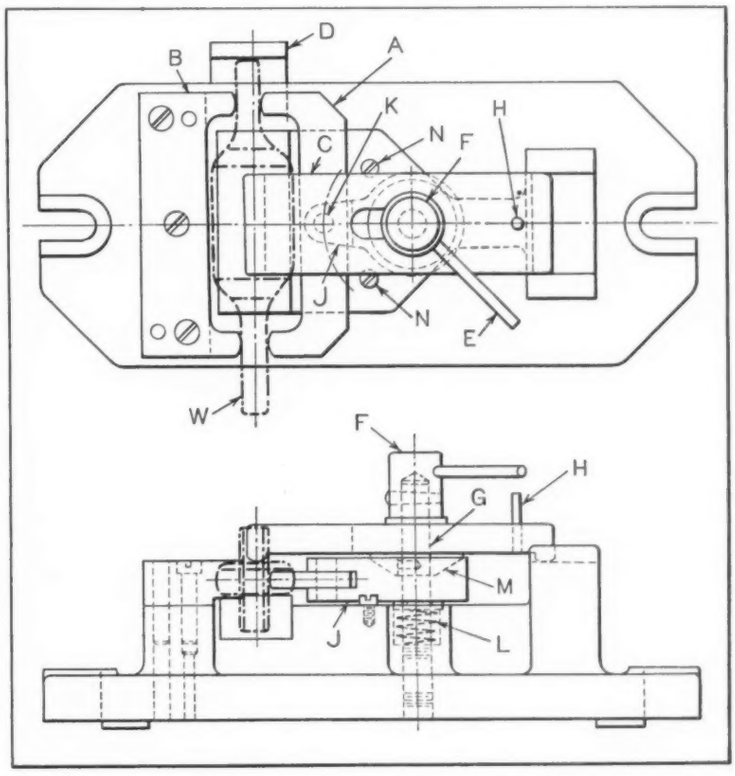
An interesting feature of the fixture illustrated is the work-locating member *A* which pushes the work *W* sidewise against block *B* and against the end-stop *D* before pressure is applied by clamp *C*. The tightening of clamp *C* by means of rod *E* causes link *J* to rotate and actuate the locator *A* before the clamp is tightened on the work. The pressure exerted by the locator is released when clamp *C* is loosened.

The knob *F* is pinned to the end of the clamping screw *G*, which is screwed into a threaded hole in the base of the fixture. The locator or positioning member *A* is supported in the link *J* and is free to pivot about the pin *K*. A spring *L* presses against the under side of link *J* and forces it against a beveled friction sleeve *M*. A pin in screw *G* enters a slot in sleeve *M*, causing it to revolve with the clamping screw.

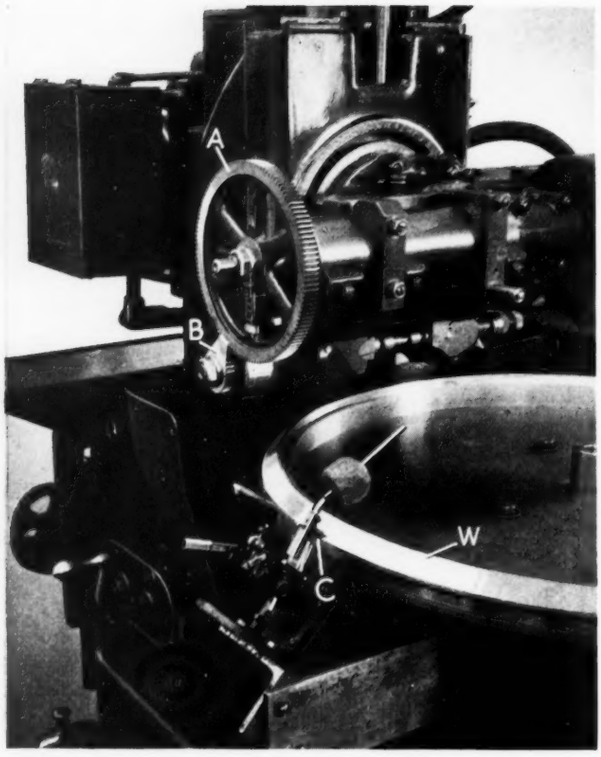
As knob *F* is revolved by handle *E*, the friction between sleeve *M* and link *J* causes the latter member to revolve clockwise and force locator *A* against the side of the work, so that it is clamped against block *B*. When sufficient pressure is exerted on the work, sleeve *M* will slip in its bearing and clamp *C* will tighten down on the work. Two fillister-head screws *N* limit the movement of link *J*, preventing it from getting out of the operative position.

In removing the work from the fixture, the clamp is first loosened, causing the side-gripping member *A* to be drawn away from the work through the medium of the link mechanism. Clamp *C* is then drawn back by means of pin *H*, permitting the work to be removed.

Comparatively simple devices of this kind often greatly facilitate the handling of work in fixtures and decrease the time required for loading and unloading the work in the fixture.




Fixture Equipped with Work-locating Member A, which is Actuated by the Clamping Screw G before Pressure is Applied by Clamp C




Gear-hobber Equipped for Graduating Face W with 1440 Equally Spaced Divisions

## Using the Gear-Hobber as a Graduating Machine

By O. S. MARSHALL, Pasadena, Calif.

The gear-hobbing machine, in many respects, is better adapted for graduating circles than the milling machine. In using the gear-hobber, it is geared for the exact number of divisions, the same as in cutting a gear. The work is rotated by hand, using the regular crank, the power drive being disengaged by removing the driving gears.

The illustration shows a gear-hobber set up for making 1440 divisions or graduation marks on a 36-inch circle of an indexing wheel *W*. The graduation lines are scribed on the 45-degree face of the wheel. Triple compounding of the indexing gears of the hobbing machine was necessary to give the required 1440 divisions for one complete revolution of the work, or one division for each complete revolution of the cutter-spindle. A 120-tooth gear *A* with an index line well marked on its side is used on the end of the cutter-spindle for indicating the indexing movements. A corresponding index line is made on a strip of sheet brass *B* and attached as shown. One revolution of the index-gear *A* will index the work one division or graduation.

The ruling instrument with the scribing tool at *C* is attached at the side of the work saddle by means of channel iron, angle iron, and flat bars, arranged as shown. Any type of instrument for making the lines can be used. It is desirable, however, to have the instrument operate automatically with respect to scribing the several different lengths of lines ordinarily required. The important point is the simplicity of the indexing movements over those required in using the dividing-head method, where one or more turns, plus fractional turns, are necessary for a single division, whereas the wheel *A* on the hobbing-machine spindle makes only one revolution for each division.

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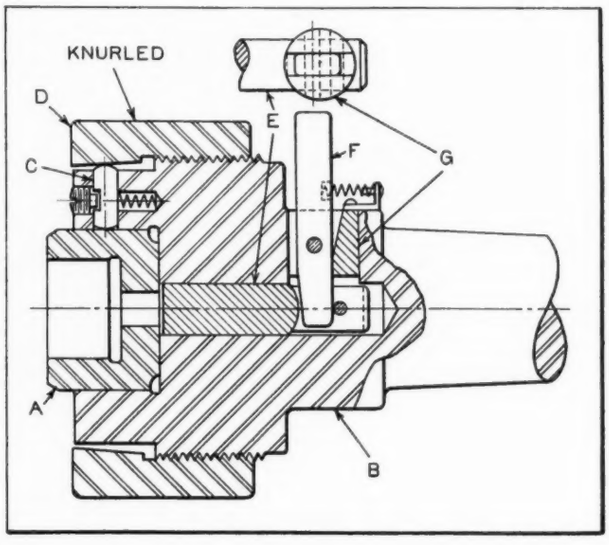
## Quick-Acting Grinding Chuck

By PHIL. E. VERAA, Richmond Hill, N. Y.

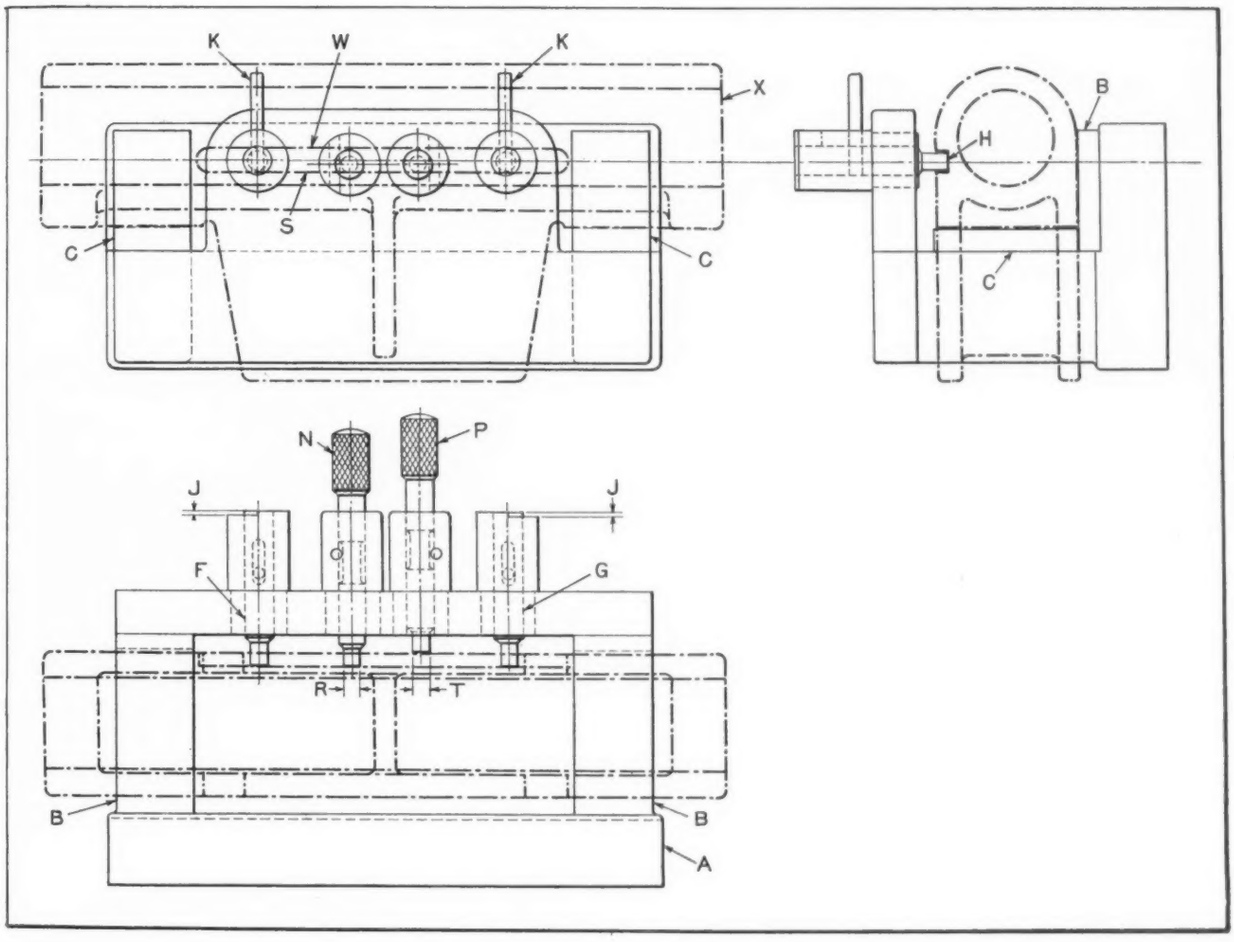
A quick-acting grinding chuck that can be adapted for a variety of small parts requiring internal grinding is shown in the accompanying illustration. This chuck is designed for use in grinding the bore of the dial knob *A*. The chuck body *B* is made with a tapered shank to suit the spindle of the grinding machine or lathe. The hole in which knob *A* is held is approximately 0.008 inch larger than the outer diameter of the part.

There are three plungers *C* of hardened drill rod, spaced 120 degrees apart. When the cap nut *D* is screwed on the body of the tool, the tapered seat forces the plungers against the part, clamping and centralizing it in the chuck. A coil spring is provided in back of each plunger to hold it in approximately the open position, and a pilot screw restricts its movement to the working range.

The knock-out rod *E* is operated by swinging lever *F* to the right. The tongue of a screwdriver or other tool may be inserted between the chuck body and lever *F* to force the lever to the right and thus operate rod *E*. This feature saves time, as it is much quicker than the common method of knocking out the part through the spindle hole of the machine. The knock-out lever *F* is fitted in a slot




Chuck Used in Grinding Bore in Part A




Fixture Type Gage for Testing Location and Depth of Groove W in Part X

in bushing *G*, where it is a turning fit on a pin. A compression spring keeps the knock-out mechanism steady and normally holds the knock-out *E* in the rear position.

## Gage for Testing Depth and Location of Groove

By F. SERVER

The fixture type gage here illustrated is used to test the depth and the location of the slot *W* in the piece *X*, indicated by the heavy dot-and-dash lines. The piece to be tested is slid into place against finished surfaces which locate it accurately for gaging the depth of the slot at *H* by means of the flush pins *F* and *G*. The weight of the work holds it down against the hardened steel locating plates *B*, while the operator holds the work against the hardened plates *C*. One flush pin with a gaging step *J* is used near each end of the slot *W*, so that the parallelism of the slot with respect to the base and the depth will be gaged simultaneously. The pins *K* which pass through elongated slots in the sides of the bushings are employed for moving the flush pins up and down.

The sidewise location of the slot is gaged by "Go" and "No Go" plugs *N* and *P*. The lower end of plug *N* is made of such a diameter *R* that it will not quite come in contact with one side *S* of the slot, and therefore serves as the "Go" limit for the location of the slot relative to the finished surfaces on the work which are in contact with plates *C*. The lower end of plug *P* is of such a diameter *T* that it will not go or slide past the surface *S*, and therefore registers the "No Go" limit for the sidewise location of the slot. A standard plug type "Go" and "No Go" limit gage is used for gaging the width of the slot. This method of gaging insures interchangeability with regard to the location and depth of the slot *W*.

## Shaving Die Equipped with Safety Devices

By EDWARD HELLER, Cleveland, Ohio

The accompanying illustration (see next page) shows a shaving die designed for finishing the profile of the part *A*. This part is about 1 inch long, and is blanked out from sheet stock 1/8 inch thick. The die has been designed with a view to making the job safe both for the operator and the tools.

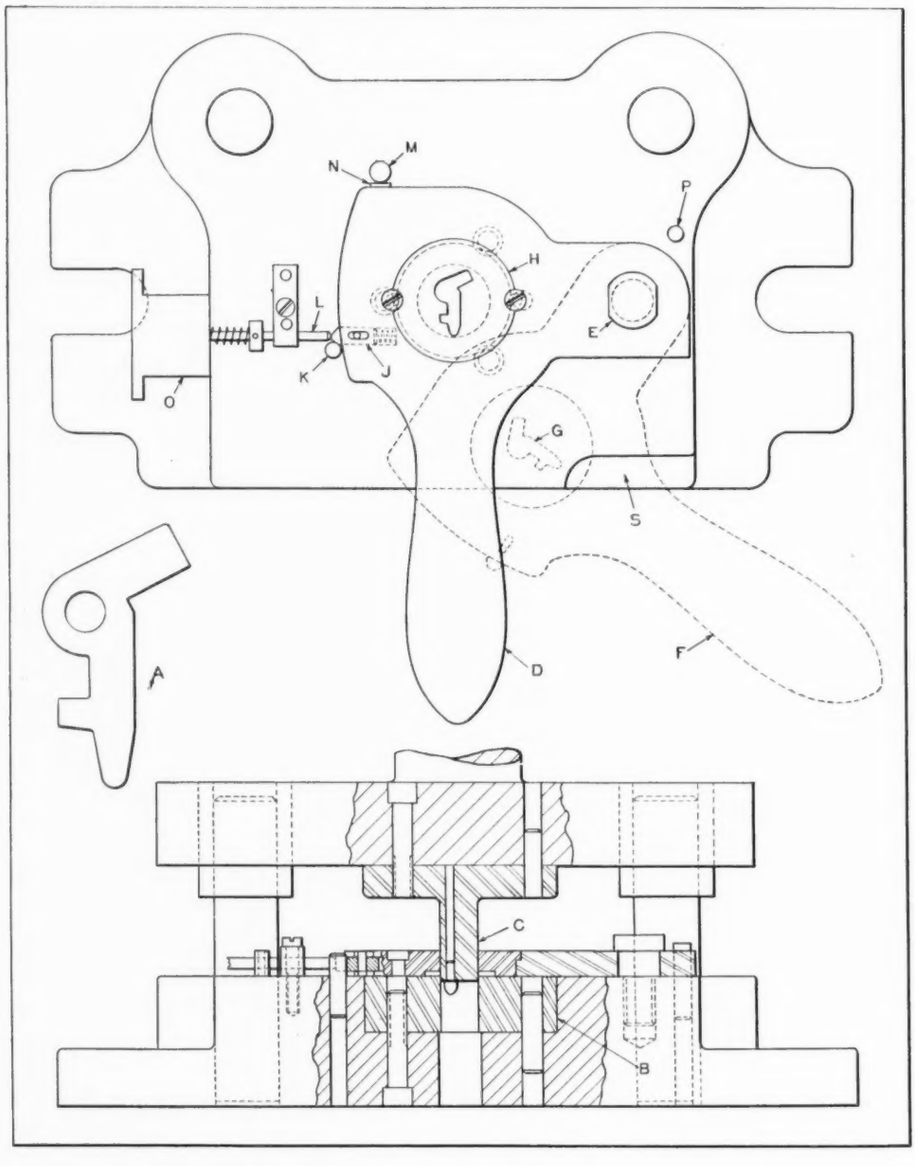
The shaving die *B* and the punch *C* are of conventional design, but the matrix-holder *D* pivots on stud *E* to the position shown by dotted lines at *F*, so that the operator can load the stamping at *G* near the front edge of the die-shoe. When the blank is safely deposited in its nest *H*, the operator swings the holder into position under the punch, as shown by the full lines in the upper or plan view of the die. The swing of the latch is limited by button *N* and stop-pin *M*.

Just as the matrix-holder reaches its final position ready for the shaving operation, the latch *J* snaps past the pin *K* and comes into contact with the rod *L* which, in turn, makes an electrical contact in the box *O*. The leads, not shown, from the contact box are connected to a solenoid at the clutch mechanism in such a way that the clutch can be operated only when the circuit is closed. Thus the clutch cannot be engaged unless the stamping to be shaved is properly located under the punch. The clutches on the particular presses used on this work are operated by a hand-lever instead of a foot-treadle. The two operations, therefore, require the use of both hands, thus keeping them out of the danger zone.

It might be interesting to note that in the original design, the back-stop, which is now in the form of the stud *N* and pin *M*, was in the nature of a compression spring arrangement which required the operator to keep the holder *D* pressed tightly against the stop. It was found, however, that this arrangement placed an unnecessary strain on the operator. With the present arrangement, if the operator wishes to work fast, the hand need not release its grip on the holder *D*.

The shape of latch *J* is such that if the two members *M* and *N* are as little as 1/64 inch apart, the electrical contact will not be made and it will be impossible to engage the clutch. During the up stroke of the ram, the operator swings the matrix-holder *D* clear over to the right until it is stopped by pin *P*. The opening in the work-locating nest is thus brought over the step *S* cut in the die-plate to allow any shavings that may be left in the matrix to either drop out or be cleaned out by the operator. The matrix-holder is then swung back to the position shown by the dotted lines at *F* where the opening at *G* is ready to receive another blank.

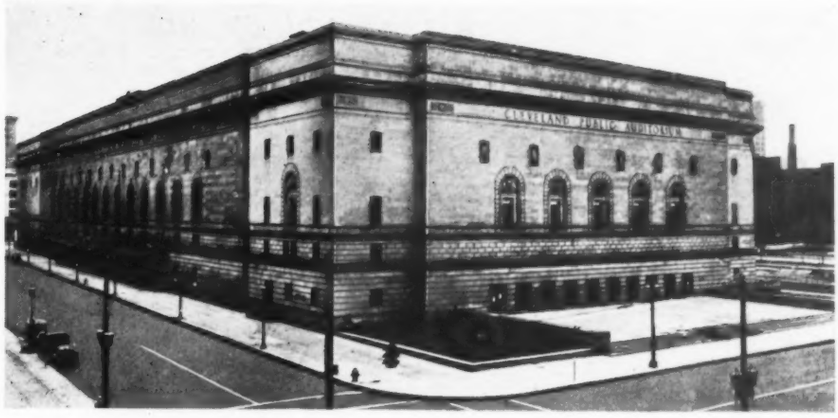
The "shaving" removed from the work is only about 0.005 inch thick and usually remains on the punch. As it accumulates and reaches the punch flange, it is broken and falls away. The occasional shaving that remains in the nest will fall out due to the 1/16-inch under-cut in the locating nest. This under-cut is equal to one-half the thickness of the piece shaved.




Shaving Die Equipped to Prevent Injury to Die or Operator

* * *

Of the passenger cars produced last year, approximately 95 per cent had a wholesale value of less than $750 each.



# *The Eighteenth Annual National Metal Exposition*

**CLEVELAND, OCTOBER 19-23**

THE plans made by over two hundred leading companies in the metal industries in connection with the eighteenth annual National Metal Exposition, to be held in the Public Auditorium, Cleveland, Ohio, October 19 to 23, under the auspices of the American Society for Metals, are a very definite indication of present industrial activity and of confidence in continued expansion. This exposition promises to be one of the largest shows, if not the largest, ever sponsored by the Society. Almost all of the companies have increased their space requirements over last year. The total exhibition floor space will be over 175,000 square feet.

The exhibition has become an annual institution in the metal industries, and includes both materials and manufactured products, as well as metal-treating equipment. While iron, steel, and non-ferrous metals form the backbone of the show, materials of every kind, including the newly developed synthetic plastics, will be well represented. Equipment for welding, cutting, heat-treating, inspecting, and testing metals form an important section of the exhibition. Machine shop equipment, precision tools and instruments, abrasives, cutting and lubricating oils, and rustproofing compounds will also be in evidence. Many of the exhibits will be in operation.

In conjunction with the exposition, the American Society for Metals will hold its annual convention. The program this year is the largest and most comprehensive ever scheduled. Papers will be presented each morning and afternoon during the entire exposition, with the exception of Wednesday morning, when the Society's annual meeting will be held. Practically every branch of the metallurgical industry and the treatment of metals will be covered by one or more papers. A symposium on the plastic working of metals will form one of the chief features of the convention.

Aside from the American Society for Metals, the following societies participate in the Metal Congress: The American Society of Mechanical Engineers, the American Welding Society, the American Institute of Mining and Metallurgical Engineers, and the Wire Association.

The American Society of Mechanical Engineers, with headquarters at the Hotel Cleveland, will hold its meetings Thursday, October 22, and Friday, October 23. The program will be concentrated on the subject of welding, and some of the sessions will be held jointly with the American Welding Society, which will hold its seventeenth annual meeting at the Hotel Cleveland during the entire week of the exposition. A very large number of papers will be presented, dealing with practically every phase of the welding industry. The Wire Association will meet October 19 to 22, holding technical sessions during the last three days. Headquarters will also be at the Hotel Cleveland.

The Metals Division of the American Institute of Mining and Metallurgical Engineers will have headquarters at the Statler Hotel. There will be technical sessions October 20, 21 and 22, all of which, except those on Wednesday afternoon, will be held at the Hotel Statler. The Wednesday afternoon sessions will be held at the Public Auditorium. The Iron and Steel Division of the Institute will also hold sessions on blast furnace operation, open-hearth steel problems, and X-ray metallography.

# *A Preview of Some Exhibits at the Cleveland Metal Show*

A FEW of the exhibits at the Metal Show, displaying either recently brought out equipment or newly developed materials, are referred to in the following pages. It is not possible in this brief review to mention all the exhibits, but new materials and equipment not included will be referred to in coming numbers of MACHINERY.

As in former years, the largest section of the National Metal Exposition will be the industrial gas exhibit, sponsored by the American Gas Association. One large unit of floor space in the main section of the Public Auditorium has been reserved for this exhibit. About a dozen individual exhibits will be grouped around a roomy lounge maintained by the Association.

A new furnace brought out by the Lindberg Engineering Co., Chicago, Ill., known as the "Cyclone" furnace, is one of the features of the heat-treating equipment exhibition. This furnace, shown in Fig. 1, is a gas-fired tempering furnace. A motor-driven fan forces a large amount of air at high velocity through a fan chamber which is interposed between the combustion chamber and the work chamber. The hot gases in the combustion chamber are mixed in proportions of approximately 1 to 50 with the circulating gases that have already passed through the work chamber. This mixture passes up through the fan, enters an annular distribution duct at the top of the work chamber, and is drawn down through the work chamber and back into the fan chamber. When the temperature of the air leaving the fan, as read by a pyrometer, reaches control temperature, the burner is closed by a motor-operated valve. Then circulation ceases through the combustion chamber, but a blast of air continues through the work chamber. The automatic control which operates in conjunction with the pyrometer reduces the heating rate to exactly equal the heat absorption of the furnace. This feature eliminates thermo-couple lag.

A controlled-atmosphere, mesh-belt, brazing furnace in operation will be a feature of the General Electric Co.'s exhibit. Regular production runs of many types of intricate assemblies will be electric-furnace brazed throughout the duration of the exposition. In addition, two sizes of portable motor-generator welders, three welding transformers, a gasoline-driven portable welding generator, and different types and sizes of electrodes will be displayed. All the welding units exhibited will be in operation.

A new design of oven furnace, Fig. 2, will be exhibited for the first time by the American Gas Furnace Co., Elizabeth, N. J. While this furnace

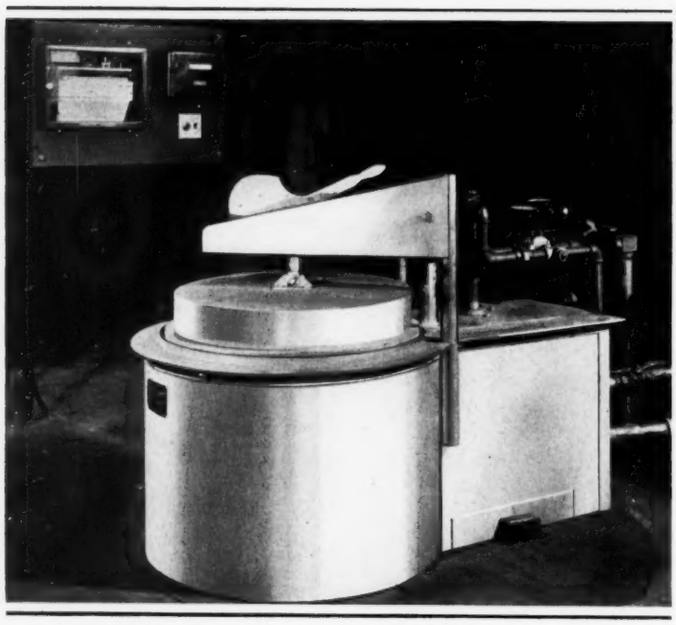


*Fig. 1. Lindberg Gas-fired "Cyclone" Tempering Furnace to be Exhibited at the Metal Show*

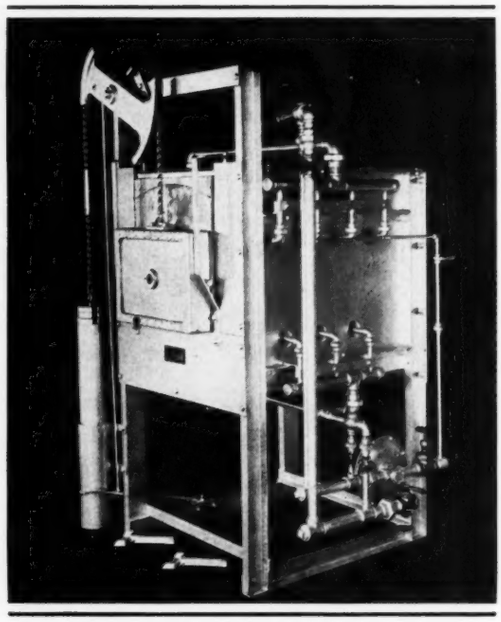


*Fig. 2. American Gas Furnace Co.'s New Design of Oven Furnace*

*Fig. 3. Leeds & Northrup New Small Homo Tempering Furnace Adapted for Tool-room Use*

does not differ materially in appearance from the company's standard oven furnace, decided improvements have been made in the method of firing it.

Burners are provided at the top and bottom and on both sides. The furnace is bottom-vented, which is a decided departure from customary design. There is no vent or opening in the top of the furnace; hence the combustion gases must pass out through the bottom vent or through the door when it is opened. The greater part of the heat is provided by the top burners, which fire under the arch. The bottom burners are used to the extent necessary to maintain uniformity throughout the chamber in large furnaces, especially those with a high heating chamber.

By bottom-venting, the chimney action of the conventional under-fired top-vented furnace is avoided. This means that cold unburned air cannot be drawn into the furnace when the door is open; the atmosphere throughout the heating chamber consists of combustion gases. When the mixture is properly set, these gases will be of such composition as to reduce scaling or decarburization to a minimum. Since the coldest gases escape at the bottom, the heating efficiency of the furnace is increased and the gas consumption reduced.

The Leeds & Northrup Co., Philadelphia, Pa., is showing the new Homo furnace, Fig. 3, for the first time. This is a smaller model than the regular Homo furnace, and is designed for tool and die tempering, embodying the Homo principle of uniform heating. A dense-load Homo furnace will be in operation, and temperature-exploration tests will be run at frequent intervals to show the speed and uniformity of heating. A triple-control Hump hardening furnace will also be shown in operation to demonstrate the control of atmosphere, rate of heat input, and quench point. Anyone bringing a sample piece to the booth may have it hardened.

The new Micromax electric control described in July, 1936, MACHINERY, page 754, will be demonstrated in use with a model furnace built by the same company. An operating demonstration will also show the Leeds & Northrup method of automatic open-hearth reversal from temperature-difference. A special Micromax indicating controller will show the difference in temperature between the two ends of the furnace, and will automatically reverse the furnace when the difference reaches a predetermined limit. A six-point multi-color Micromax indicating recorder makes a permanent record of the temperatures in the gas and air checkers, and of the gas entering and leaving the waste heat boiler. A demonstration of Speedomax recorders and of the Rayotube will show how temperatures of steel during processing can be obtained in less than two seconds.

The central feature of the exhibit of the Ajax Electric Co., Inc., Philadelphia, Pa., will be the new Ajax-Hultgren salt bath furnace that has recently been described in the technical press. This furnace is characterized by its extreme simplicity of operation. A pair of metal electrodes are immersed in the salt, through which an alternating current is passed which heats the salt by direct resistance. The two electrodes are arranged in close proximity on the same side of the bath, so that the working space is kept distinct from the heating zone.

Restricting the heating zone to the side of the bath in this manner does not prevent uniform heating, but actually promotes it, due to the patented arrangement of the electrodes in the bath which utilizes electromagnetic forces in such a way as to provide an automatic stirring action throughout the entire salt bath. As a result, the temperature distribution is uniform, regardless of the size of the bath.

Several radiant tube heating elements in actual operation will be exhibited by the Surface Combustion Corporation, Toledo, Ohio. This is believed to be the first time that the radiant tube has been exhibited in operation at an engineering show. The corporation is also exhibiting a small controlled-atmosphere furnace; an air heater for temperatures as high as 1200 degrees F.; burners and inspirators (air-gas mixers); and samples of work heat-treated in various types of furnaces. The corporation has so arranged its exhibit as to feature the most outstanding developments in the furnace industry in the last few years.

An "Optimatic" pyrometer demonstration is part of the exhibit of the Brown Instrument Co., Phila-

delphia, Pa., showing how temperature records of bars, sheets, and shapes can be obtained while they are being rolled. In addition, the exhibit will include radiation pyrometers, furnace pressure controllers, combustion safeguard equipment, and several types of motor-operated valves. As a whole, it will cover indicating, recording, and automatic control instruments used in the production, fabrication, and heat-treatment of metals.

Demonstrations of hardened, self-tapping, sheet-metal screws will form part of the exhibit of the Parker-Kalon Corporation, New York City. The holding power of fasteners under torque and tension stresses will be shown by suitable testing equipment. Animated models will demonstrate the advantages of labor-saving fastening devices.

The American Brass Co. will display a selection of high-strength copper alloys, including Everdur metal, beryllium copper, Tempaloy, Tobin bronze, and several phosphor-bronze alloys. These will be shown both in commercial and fabricated forms. Another feature of this company's exhibit will be a welding demonstration, covering all types of welding with bronze rods and long-arc, high-voltage welding of copper.

A feature of the exhibit of the Bethlehem Steel Co. will be a moving panorama of four 4- by 8-foot murals, showing the production of strip sheet in the new Bethlehem continuous mill at Lackawanna, N. Y., together with a working model of one of the radiant-tube annealing furnaces employed in the cold-mill division. The exhibits will also include a varied line of Bethlehem products, such as wire, castings, sheets, and corrosion-resisting steels.

*Fig. 5. Abrasive Wheel Cutting-off Machine which Will be Exhibited by A. P. de Sanno & Son, Inc.*

*Fig. 4. An Electric Brazer for Brazing Saw Bands, to be Exhibited by Grob Brothers*

The exhibit of the American Rolling Mill Co., Middletown, Ohio, will feature the new widespread uses of porcelain enamel and stainless steel in industry, in business, and in the home.

A new class of lubricants known as "extreme pressure" or EP has recently been developed to meet the demand for greater bearing pressures in machine tools, gearing, and other cases where lubricants must withstand great unit pressures. D. A. Stuart & Co., Chicago, Ill., will exhibit a full line of this type of lubricants and greases, and will demonstrate the difference between the "extreme pressure" and ordinary lubricants by means of a lubricant testing machine.

An electric brazer, Fig. 4, for brazing saw bands up to 1 1/2 inches wide will be one of the features of the exhibit of Grob Brothers, West Allis, Wis. A transformer is mounted in the base of the device. The secondary coil has extensions through the top of the cover which provide for clamping and proper alignment of the saw band ends to be joined. A center clamp for pressing the saw band ends together when brazed is operated with a handle. A switch is connected with the various windings of the primary coil and provides for three different heats. The brazer is made for either 110 or 220 volts, single-phase, 60-cycle alternating current.

A Type J Radiac cut-off machine, Fig. 5, designed especially for the "wet" cutting-off of bar stock and tubing will be exhibited by A. P. de Sanno & Son, Inc., Philadelphia, Pa. This machine has a capacity for cutting solid metal bars 2 inches in diameter and tubing up to 3 1/2 inches in diameter. It is adapted for cutting materials that lend themselves better to wet cutting than to the dry method. For this work, it performs the cutting operations at the proper speed to reduce the burr to a minimum and give a smooth, clean-cut edge.

A Type F machine, designed for use in plants where the different kinds of materials to be cut are limited in quantity and size, will also be exhibited. The latter machine can be mounted on a movable bench, so that it can be quickly taken to any part of the plant. This machine has a capacity for cutting solid metal stock up to 3/4 inch in diameter, and will cut metal tubing and fibrous materials in sizes up to 1 1/4 inches in diameter. It is particularly adapted for use in cutting stock used for tool bits, drills, reamers, and similar work.

The Linde Air Products Co., in conjunction with the Electro Metallurgical Co. and the Haynes Stellite Co.—units of the Union Carbide & Carbon Corporation—will have an extensive exhibit. Several of the latest cutting machines will be on view to show the various applications of flame cutting. The new Oxweld Type CM-12 shape-cutting machine, which covers a range of work hitherto impossible to handle on one machine, will be in operation. The acetylene generators introduced during the last few months will be shown, as well as a new line of Oxweld oxygen and acetylene regulators.

The new shape-cutting machine, shown in Fig. 6, will widen the scope of shape-cutting. It is more powerful and has a greater cutting capacity than former machines in its class. Any shapes can be accurately produced either automatically with templets or by hand. The machine will also cut straight lines automatically in any direction and at any bevel. It is possible to make cuts as long as 12 feet. An attachment is provided for automatically cutting circular shapes with 2 to 24 inches radius.

The machine is also equipped for multiple cutting, and can carry from two to five blowpipes which perform multiple cutting under all the conditions possible with a single blowpipe. The speed range is 1 1/2 to 75 inches per minute. Materials up to 12 inches thick can be regularly handled; for heavier cuts, a special blowpipe is available.

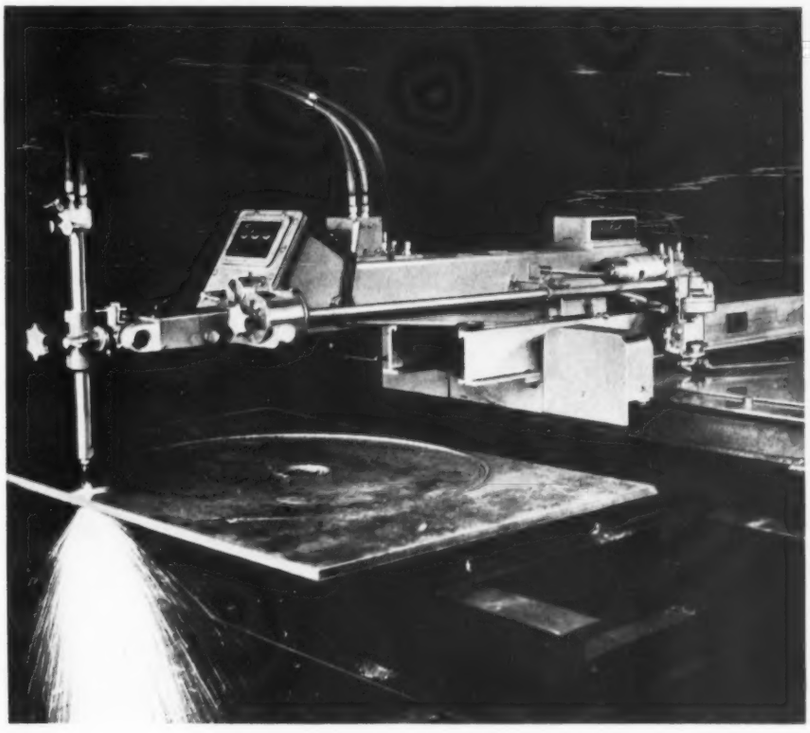


*Fig. 6. A New Shape-cutting Machine with Increased Capacity, to be Exhibited by the Linde Air Products Co.*

## *New Carpenter Temperature Compensator Alloy*

An iron-nickel alloy of such characteristics that its magnetic permeability decreases in proportion to increase in temperature within the usual range of atmospheric temperature variations has been developed by the Carpenter Steel Co., Reading, Pa. This alloy is used for the manufacture of magnetic shunts applied to meter magnets to compensate for temperature changes. It is obtainable either in bar form or in the form of cold-rolled strip suitable for blanking and forming.

# *New Applications of Stainless Steel*

PERHAPS no material has ever been developed that has so rapidly found a place for itself in industry as stainless steel. The reason for the almost sensational growth of stainless steel tonnage is to be found in its ever widening fields of application. When first developed, its primary and almost sole use was for making rustproof tableware and cutlery; and while this was an important use of wide possibilities, its applications have expanded until stainless steel is now a most important factor in a great many fields, such as the oil, textile, chemical, heavy machinery, automotive, paper, food preparation, house furnishing, aeronautical, and building industries.

The marked increase in the production of stainless steel from year to year, even during the most severe depression years, is the best indication of the firmly established place of this new material. When the tonnages of ordinary steel production declined sharply from 1929 to 1933, the tonnage of stainless steel continuously advanced. Since 1933 the recovery in ordinary steel products has been comparatively slow, while in stainless steel, the increase has continued at an accelerated pace. In 1929, the tonnage of stainless steel produced was 40,000 tons; a conservative estimate of the production for 1936 is 100,000 tons—the equivalent of two and one-half times the output in the boom year, seven years ago.

Another notable fact about stainless steel is that while a comparatively few years ago it was considered mainly a curiosity among steel alloys, in which only a few courageous mills were interested, it has now gained such recognition as a standard product that steel companies heretofore interested only in producing a large tonnage of comparatively cheap steel are now producing their fair share of this relatively high-priced alloy steel. Part of the reason for this ready acceptance of stainless steel as an industrial material is due not only to its corrosion-resisting qualities, but also to the fact that the metal has exceptional physical properties, at both very low and very high temperatures, as well as at ordinary room temperature.

The growing consumption of stainless steel will naturally have the effect of reducing the cost of production, and the lower prices thus made possible will automatically broaden the fields of application. Thus the success of this material is partly due to a favorable economic cycle that promises constantly increasing production and application.

Among the many unusual applications of this material may be mentioned stainless steel wire for yacht rigging, stainless steel trucks for delivery purposes that help to advertise a manufactured product, stainless steel light-weight high-speed trains, stainless steel watches for sportsmen, and stainless steel for architectural decorations.

# *Jones & Laughlin "Jal-Ten" Steel*

A NEW open-hearth manganese copper-bearing steel of high strength and resistance to weather corrosion, known by the trade name "Jal-Ten," has recently been brought out by the Jones & Laughlin Steel Corporation, Pittsburgh, Pa. The new material was designed specifically for railway car construction, but obviously will find application for many other purposes.

In developing this steel, it was the purpose to meet the following requirements: High tensile strength and yield strength with adequate ductility and impact qualities; considerable stiffness to resist flexure and deformation; resistance to abrasion; and resistance to all types of corrosion expected in railway service. By meeting these requirements, weight reduction and longer life in railway car construction would result. Obviously, a steel meeting these requirements would also have to lend itself to hot- and cold-working, and welding.

The composition of the steel is as follows: Carbon, maximum, 0.35 per cent; manganese, from 1.25 to 1.75 per cent; phosphorus, maximum, 0.04 per cent; sulphur, maximum, 0.05 per cent; silicon, maximum, 0.30 per cent; copper, minimum, 0.40 per cent.

The physical properties of the steel are as follows: Tensile strength, minimum, 80,000 pounds per square inch; yield point, minimum, 50,000 pounds per square inch; elongation in 2 inches, minimum, 20 per cent; Brinell hardness, minimum, 160. The atmospheric corrosion resistance is estimated to be over three times greater than that of ordinary open-hearth steels.

The new steel lends itself well to drilling and punching for riveting, and can be either hot- or cold-formed in regular shop practice. "Jal-Ten" is readily weldable by the usual fusion welding methods.

# *Constantly Increasing Use of Nickel Steels and Alloys*

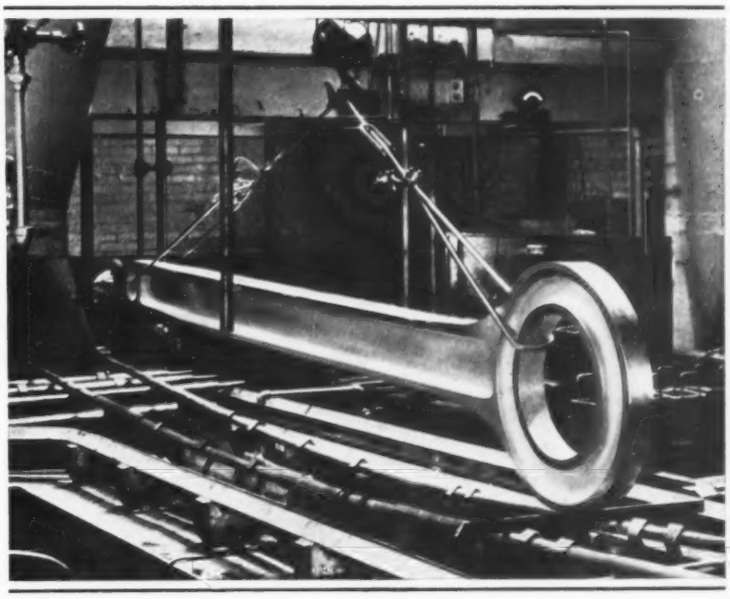
IT is not news that alloy steels are being used to an ever increasing extent; but some of the new applications of alloy steels, among which nickel steels hold a most prominent position, furnish many items of news. The use of alloy steel for locomotive main- and side-rods, for example, is a quite recent application which has proved advantageous in actual service.

In July, 1934, the Pennsylvania Railroad equipped a locomotive with a complete installation of roller-bearing main- and side-rod forgings, designed by the Timken Roller Bearing Co., and made from high-tensile strength nickel alloy steel. Since then, this locomotive has run 96,000 miles in regular passenger service between Pittsburgh and Columbus with perfect satisfaction. By using high-strength nickel alloy steel, a total reduction of 508 pounds was effected in the weight of the reciprocating parts. At a speed of 100 miles per hour, this results in a reduction in total crankpin load of approximately 48,500 pounds. It is stated that this locomotive may run up to 117 miles an hour before the same dynamic conditions are created as in the ordinary locomotive with plain bearings and conventional reciprocating parts when running at 90 miles an hour.

The illustration below shows a heat-treated alloy-steel locomotive main-rod in the process of being chromium-plated. This is one of the set just referred to, consisting of two 12-foot main-rods and four 9-foot side-rods. The chromium-plating job on these rods is said to be the largest ever accomplished in one operation. It required the construction of a specially designed plating tank 17 feet long.

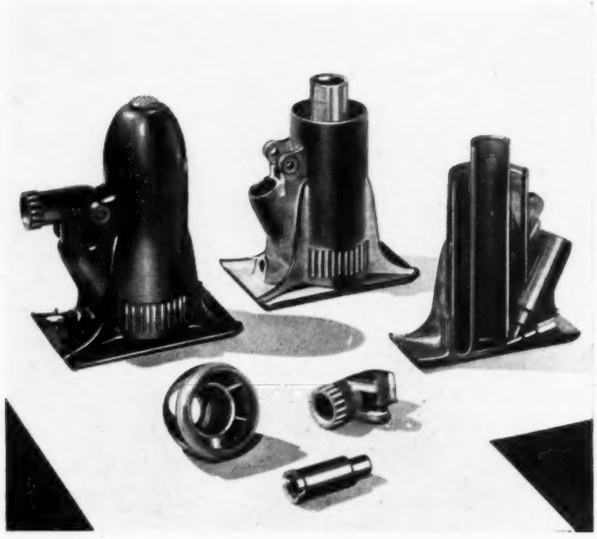
At the present time, the nickel-molybdenum steel S A E 4640 is being successfully used in the automotive industry for transmission gears, shafting, clutch parts, and high tensile strength bolts. Doubtless this steel will find still wider application in industry when its excellent properties become better known. The Warner Gear Co., in 1932, was the first to adopt this steel for regular gear production. E. E. Davis, metallurgist of the company, summarizes the qualities of this alloy steel as follows: (1) High tensile strength; (2) excellent impact values; (3) high fatigue resistance; (4) good surface hardness; (5) wide heat-treating range; and (6) minimum distortion in heat-treatment. It is stated that tests have shown that gears made from this steel have a life three to four times that of some other alloy steels with similar carbon content.

No figures are available on the total tonnage of nickel and nickel alloys used in the new steamship *Queen Mary*, but it reaches large proportions. In her main condensers alone, where spent steam is converted back to boiler feed water, 162 tons of an alloy containing 70 per cent copper and 30 per cent nickel are used for tubes and ferrules. The same alloy is also used in condensers for the auxiliary equipment, including more than 7 tons for the electrical power plant condensers.



***An Alloy-steel Locomotive Main-rod, Designed and Made by the Timken Roller Bearing Co., being Chromium-plated in a Specially Designed 17-foot Long Plating Tank***

# *Die-Castings are Finding Many New Uses*

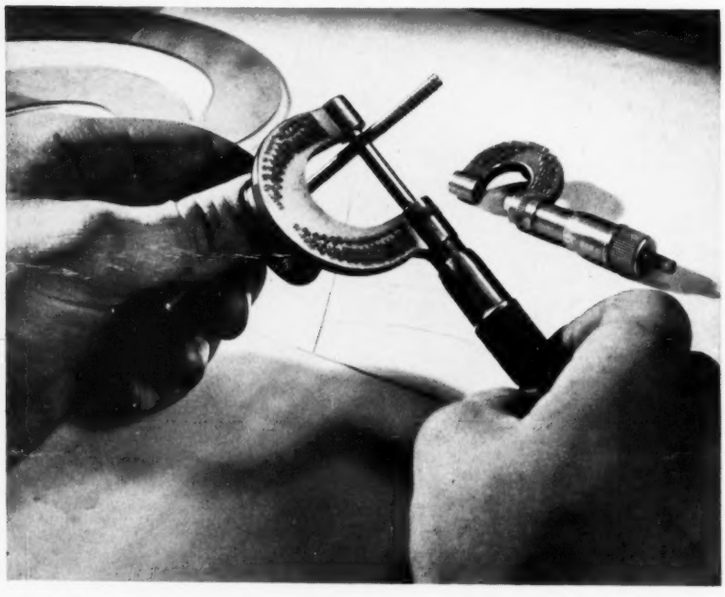


*A New Hydraulic Automobile Jack Made by the Blackhawk Mfg. Co., in which the Cylinder, Reservoir, and Pump Chamber are Fabricated from a Single Zinc Alloy Die-casting, thereby Reducing the Number of Parts to a Minimum —Photograph, Courtesy New Jersey Zinc Co.*

DURING the last year, the constantly increasing importance of the die-casting industry has become more and more evident. The power-driven semi-automatic die-casting machines of today, utilizing pressures of thousands of pounds, are producing more and more intricate and larger and larger castings. Among the recent developments in die-casting, according to the Doehler Die Casting Co., Toledo, Ohio, is the application of die-castings on textile machinery. The Universal Winding Co. is using a die-cast gear-box consisting of a six-piece assembly, replacing the older cast-iron mechanism. Since there are as many as fifty units to a machine, each unit weighing over 20 pounds, the importance of this innovation is apparent. There are decided advantages in the simplicity of design, elimination of finishing, dust-proofing, etc. The new housing also offers an opportunity to use enclosed lubrication, which could not be done with the old design.

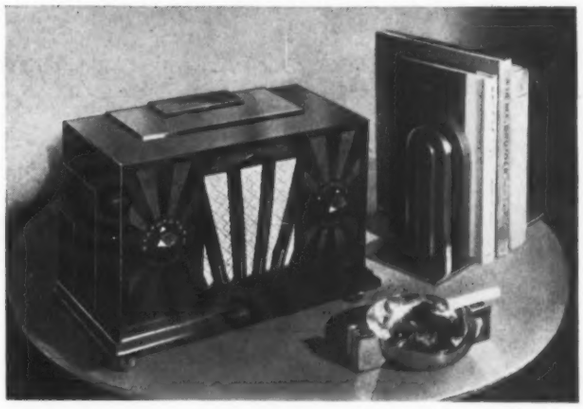
Other recent developments include a thermostatic control for automobile radiators, die-cast from brass. Numerous die-cast parts are also used in air-conditioning equipment. Zinc plumbing hardware is now being die-cast in greater volume than ever before. Last, but not least, a new high-grade miniature camera utilizes aluminum die-castings for a very fine-looking and ingenious mechanism.

The automobile industry is the largest single user of die-cast parts. It is estimated that, on an average, there are 25 pounds of die-castings used for every car built. In some cars, there are as much as 50 pounds of die-castings, and in one case, 80 pounds of die-cast parts are used. The tremendous growth of the use of die-castings in automobiles is chiefly attributable to their widespread application for radiator grilles, radiator grille frames, side louvers, moldings and other large parts that formerly were made from stampings.



*A Die-cast Micrometer Frame—an Indication of the Many Unexpected Fields that are Invaded by the Die-casting Industry — Photograph, Courtesy Doehler Die Casting Co.*

# *New Applications of Synthetic Plastics*



*The Attractive Design of the "Tom Thumb, Jr." Radio Housing Made from Bakelite Molded is Another Indication of the Possibilities of Plastics for Decorative Purposes*

ONE of the most direct applications of plastics in the machinery field is their use for abrasive wheels bonded with Bakelite resinoid, made by the Bakelite Corporation, New York City. Through the use of this bond, the advantages of higher speed are made available for nearly all types of grinding. For industrial snagging, Bakelite-bonded wheels permit safe continuous operation at speeds up to 9500 surface feet per minute, and for cutting-off operations, up to 16,000 surface feet per minute. Grinding wheels so bonded have been found to reduce grinding costs greatly for many operations.

The most spectacular uses of Plaskon, a comparatively new urea plastic made by the Plaskon Co., Inc., Toledo, Ohio, have been for large housings. The first of these was the one made for a scale by the Toledo Scale Co., the largest plastic housing produced in this country. This has been followed by housings for radios, electric coffee mills, and meat choppers. Another application for which Plaskon is being used is electric lamp bowls. Well-known applications are automotive accessories, plumbing fixtures, stove fixtures, bottle caps, closures, buttons, etc.

The General Plastics, Inc., North Tonawanda, N. Y., has developed during the past year numerous new Durez materials to fit special applications, among which may be mentioned three that have definite industrial uses. One of these, known as "3630 Black and Brown," is suitable for parts having thin sections, which are exposed to alcohol and other solvents likely to cause bleeding of the resin or pigment. Parts made from this plastic are easy to remove from the molds and have high torque strength.

Another of the new materials is "77 SB," used for parts that must resist acids and frictional wear and that must have extremely low water absorption. This material is especially applicable for parts used in the textile or rayon industries, where great smoothness of surfaces is required.

The material "1564 Black" has unusual strength coupled with resistance to frictional wear. It is used for such parts as automotive bumper shoes, which take the impact of the alignment wedge and keep the car door tight, and wherever resistance to impact and frictional wear is of importance.

*The "Ohaus" Laboratory Scale, with Scale Plate Made of Acid- and Alkali-resisting Durez Plastic Material; Molded in One Piece with Threads for Attaching Other Parts in Assembling*

# *Condensed Review of Some Recently Developed Materials*

*Arranged Alphabetically by Trade Names*

| Class of Material | Trade Name | Properties | Applications |
|---|---|---|---|
| Rubber Substitute | **Acronal Resins** | Resins that are claimed to be equal to rubber in elasticity. Films of these resins will adhere well to most surfaces. The adhesion is improved by baking or drying. | Especially suitable for electrical insulation and for uses where resistance to mineral oils, gasoline, dilute acids, and alkalies is desirable. |
| Magnetic Alloy | **Alnico** | Alloy containing iron, aluminum, nickel, and cobalt. Usually cast and finished to shape by grinding. Magnets made from this alloy have remarkable power and will lift sixty times their own weight. | Applied to a variety of electrical uses, including blow-outs for relays, holding in magnets for large switches, special timing relays, and various control devices. Small motors and control devices formerly operated by electromagnets can be operated by Alnico permanent magnets at a great saving in cost. |
| Non-magnetic Monel Metal | **Aluminum-Monel** | When a small percentage of aluminum is added to Monel metal, the alloy becomes non-magnetic. This alloy possesses great strength. | Used for airplane parts located close to the compass, and for struts and guide wires. |
| Sheet Steel | **Armco H.T.-50** | Tensile strength, 67,000 pounds per square inch in hot-rolled grades, and 70,000 pounds per square inch in cold-rolled grades. The elongation of hot-rolled sheets is 28 per cent in 2 inches. Unusual resistance to atmospheric corrosion. | For use where a sheet steel of high tensile strength is required in thicknesses of No. 20 gage and heavier. To facilitate welding, the carbon content is low. Finished welds closely approach the unwelded steel in physical properties. |
| Cadmium-nickel Alloy | **Asarcoloy No. 7** | Bearing metal having Brinell hardness at 82 degrees F. of 33; at 390 degrees F., 7. Yield point in tension, 11,700 pounds per square inch. Elongation at 82 degrees F., 19; at 390 degrees F., 111. Compressive strength at 82 degrees F., 21,800 pounds per square inch; at 390 degrees F., 4400 pounds per square inch. | Meets the demands for a bearing metal for high-speed, high-compression engines. Since the alloy bonds directly with steel, the same composition as is used for the bearing proper can be used for bonding. No chemical compound is formed at the bond, but the nickel penetrates the steel slightly, much the same as in welding nickel to steel. |
| Sheet Steel | **A.W. 70-90** | Sheet and plate steel having a minimum yield point of 70,000 pounds per square inch, a minimum tensile strength of 90,000 pounds per square inch, and a minimum elongation of 20 per cent in 2 inches. Can be welded as readily as soft steel; can be formed cold, and bent back 180 degrees. | For use wherever high strength is required, or where lighter sections are desired than could be used with ordinary steel. Suitable where atmospheric corrosion must be resisted. |
| Alloy Steel | **Bakadie** | Alloy steel which, after heat-treatment, has a surface hardness of from 63 to 65 Rockwell, and at the same time, has an unusually tough core. The hardness insures good wearing properties and high resistance to abrasion. | Intended especially for use in making molds for producing synthetic plastic parts. Especially suitable for molds with "hobbed" impressions. |

## *Review of Some Recently Developed Materials—Continued*

| Class of Material | Trade Name | Properties | Applications |
|---|---|---|---|
| Synthetic Plastic | **Bakelite EM-2562** | This type of synthetic plastic material holds its dimensions over a long period of time under humid conditions and under high temperatures. | Developed especially for small motor end-frames, and particularly desirable for equipment used in the tropics. |
| Synthetic Plastic | **Bakelite BM-6260** | Possesses marked resistance to shock. Can be molded with a finish such as is obtained with a wood-flour filled material. | Employed, among other purposes, for telephone parts, where fine appearance must be combined with resistance to shock. |
| Non-ferrous Alloy | **Basaloy** | Non-shrinking, non-expanding metal alloy with a melting point of 255 degrees F. | Suitable for making small master patterns. Since the alloy is non-shrinking, there is no difference in size between the original and the base-alloy pattern. |
| Non-ferrous Alloy | **Bendalloy** | Alloy composed of bismuth, lead, tin, and cadmium, having a melting point of only 160 degrees F.—considerably less than the temperature of boiling water. | Used as a filler material in tube-bending operations. With this material as a filler, tubes having walls as thin as 0.007 inch have been bent to small radii. |
| Synthetic Plastic | **77 SB Black** | Highly resistant to acids and frictional wear; has low water absorption; specific gravity, 1.26. | Suitable wherever acid- or wear-resistant properties are of value; can be machined, sanded, and buffed after molding. |
| Boron Carbide | | An extremely hard material having a compressive strength of 260,000 pounds per square inch; unaffected by the strongest acids and alkalies, and little affected by heat up to temperatures of 1800 degrees F. It is lighter than aluminum. | Used in the cutting and lapping of cemented tungsten-carbides; for wire-drawing dies; pressure blast nozzles; and bearings for electric motors and high-speed spindles in grinding machines. |
| Babbitt | **Bunting Genuine** | A tin-base babbitt having high load-carrying capacity and ability to withstand high temperatures. | Suitable where high speeds, severe vibration, heavy shock, and high impact loads are met with. |
| Nickel Iron | **Cecolloy** | A nickel-molybdenum, air-furnace iron alloy having a fine homogeneous grain structure and a tensile strength of from 40,000 to 60,000 pounds per square inch. | Suitable for making large castings weighing up to 50 tons. Used for forming dies, beds of heavy-duty machines, steam cylinder liners and rings, crushing machinery, etc. |
| Aluminum Alloy | **Ceralumin** | An alloy of low specific gravity and comparatively high strength. Chilled castings, heat-treated, have a tensile strength of from 46,000 to 54,000 pounds per square inch; sand castings, heat-treated, from 38,000 to 40,000 pounds per square inch. Brinell hardness, 130 to 140. | For use wherever light-weight, high-strength castings with high fatigue value are of importance. |
| Synthetic Plastic | **Cetec No. 1389** | A cold-molded plastic compound with good heat resistance and fine appearance. Unaffected by temperatures up to 480 degrees F. Has high dielectric strength. Transverse strength, 6000 pounds per square inch. | Intended for insulating applications—suitable for heat-control knobs of electric irons, cord-connector plugs, etc. |

## *Review of Some Recently Developed Materials—Continued*

| Class of Material | Trade Name | Properties | Applications |
|---|---|---|---|
| Alloy Steel for Tubes and Pipes | **B & W Crololy 25-20** | Alloy steel containing 25 per cent chromium and 20 per cent nickel. Tubes made from this material are available hot-finished in sizes up to 6 inches outside diameter and cold-drawn in smaller sizes. Has unusual resistance to oxidation, and is suitable for continuous use at temperatures as high as 2100 degrees F. | Used for tubes and pipes in high-temperature cracking and other refinery operations, as well as for thermo-couple protection tubes, high-pressure valves, and heat-resistant tubular members. |
| Brass Die-casting Alloy | **Doler-Brass** | Die-casting alloy containing copper, zinc, and silicon. Tensile strength, from 65,000 to 75,000 pounds per square inch. Brinell hardness, from 110 to 120. Impact strength, from 30 to 36 foot-pounds. Color, light yellow. | Applicable to the production of high-strength die-castings that will take an unusually fine finish. |
| Alloy Steel | **Double-Strength Steel** | Copper-nickel-molybdenum steel made in two grades, 1 and 1A. Normalized sheets and strips, Grade 1, have a minimum yield point of 60,000 pounds per square inch; tensile strength, 75,000 pounds per square inch. Grade 1A: Minimum yield point, 70,000 pounds per square inch; tensile strength, 90,000 pounds per square inch. Physical properties of both grades can be increased another 15,000 to 20,000 pounds per square inch by "tempering" the sheets at from 900 to 1000 degrees F. | Particularly advantageous for use in the construction of railway equipment and automotive trucks carrying coal and other corrosion-promoting products. |
| Magnesium Alloy | **Dowmetal H** | Corrosion-resistant, light-weight alloy. Tensile strength of cast alloy, from 25,000 to 30,000 pounds per square inch; hardness, from 47 to 51 Brinell. Tensile strength of heat-treated alloy, 33,000 to 38,000 pounds per square inch; hardness, from 50 to 53 Brinell. | For use where comparatively high tensile strength and improved resistance to corrosion are required in a light-weight cast alloy. |
| Magnesium Alloy | **Dowmetal J** | Wrought, light-weight alloy. Tensile strength, from 41,000 to 45,000 pounds per square inch; yield point, from 28,000 to 33,000 pounds per square inch; hardness, from 51 to 58 Brinell. | Used where a wrought, light-weight alloy is required with comparatively high elongation, high fatigue endurance limit, and resistance to corrosion. |
| Synthetic Rubber | **DuPrene** | A synthetic rubber with the elastic properties of natural rubber, but impervious to alcohol, anti-freeze solutions, automobile radiator cleaning compounds, oils, and chemicals in general. | Used for many purposes where natural rubber products have failed to give satisfactory service, because of having less tendency to crack when repeatedly stretched and bent at high temperatures. Adopted by one automobile manufacturer to replace a metal spring in a packingless water pump. |
| Synthetic Plastic | **Durez No. 1544** | Characterized by light weight and strength; can be machined, sanded, buffed, or wire-brushed. Buffed surfaces have a black finish of unusual smoothness and luster. | Especially developed for telephone handles, machine parts, etc., that must possess more strength than is ordinarily expected from plastic materials. |
| Synthetic Plastic | **Durez No. 1564** | A phenolic compound containing 10 per cent graphite. Stated to have an impact strength approximately 40 per cent greater than ordinary phenolic compounds. | Suitable for cam parts, automobile door bumper shoes, building hardware, refrigerator latch bolts, and machine parts that are subjected to both friction and impact shocks. |

## *Review of Some Recently Developed Materials—Continued*

| Class of Material | Trade Name | Properties | Applications |
|---|---|---|---|
| Synthetic Plastic | **Durez No. 2491** | Synthetic plastic compound available in black, brown, and red, with higher dielectric breakdown and dielectric fatigue than obtainable in ordinary plastic molding materials. | Used especially in high-tension automobile ignition parts. Rotors and coil caps in some of the 1936 automobiles are made from this material. |
| Synthetic Plastic | **Durez No. 3973 Black** | A "non-bleeding" plastic material with high gloss finish, high torsional strength, and a compressive strength of 30,000 pounds per square inch. | Used for molded plastic parts exposed to acetone and other strong solvents or acids that, with ordinary plastic materials, may cause "bleeding" of the dye. |
| Metal Alloy that Fuses with Glass | **Fernico** | A metal alloy with a coefficient of expansion that is practically the same as that of glass and which can be fused with glass without setting up stresses either in the glass or in the alloy. The alloy can be machined, forged, punched, drawn, stamped, soldered, copper-brazed, and welded. | Used wherever tight joints are required between metal and glass, as in vacuum tubes and other devices in which lead-in wires or conducting parts must pass through gas-tight insulating seals. |
| Alloy Steel | **Hi-Steel** | A steel in the low-alloy high-tensile strength class possessing a high degree of uniformity. Minimum yield point, 60,000 pounds per square inch for sheets of 1/4 inch gage and less; 55,000 pounds for sheets of heavier gage; tensile strength, 70,000 pounds per square inch. | For use where a steel highly resistant to corrosion is required which can be readily bent, formed, stamped, and welded, and which is available in any of the ordinary forms —sheets, strips, plates, bars, and structural shapes. |
| High-strength Steel | **Jal-Ten** | Open-hearth manganese copper-bearing steel with high resistance to weather corrosion. Minimum tensile strength, 80,000 pounds per square inch; minimum yield point, 50,000 pounds per square inch; minimum elongation in 2 inches, 20 per cent; minimum Brinell hardness, 160. Three times greater resistance to atmospheric corrosion than ordinary open-hearth steel. | Specifically suitable for railway car construction and for all purposes where high strength, resistance to abrasion, and resistance to all types of corrosion such as would be met with in railway service are required. |
| Rubber Protective Coating | **Kelsanite** | Non-inflammable liquid, which can be applied to metal parts by brushing, spraying, or dipping. Protects surface from corrosion or dirt, as it is both waterproof and air-tight. Coating has high adhesive qualities, but does not vulcanize to surfaces on which it is applied. After the coating has served its purpose, it can be stripped off like a cellophane wrapper. | For the protection of parts or entire machines during storage or transportation; for protecting parts to be electroplated at points where the plating is not wanted; for "masking" portions of surfaces that are to be painted. |
| Monel Metal | **K-Monel** | Has practically the same analysis as regular Monel metal, except that about 4 per cent aluminum is added. Alloy is readily heat-treated, and in its fully hardened condition is over 350 Brinell; but it is also available in softer forms. Tensile strength, over 160,000 pounds per square inch. | For purposes where a combination of the strength of alloy steels with the corrosion resistance of regular Monel metal is important. |
| Rubber-like Product | **Koroseal** | Does not swell when exposed to many oils and greases nor disintegrate in the presence of corrosive chemicals; will resist the action of chromic acid and hot concentrated nitric acid; can be molded to any shape. Produced in a variety of colors; odorless. | High cost precludes its adoption as a general substitute for rubber, but appears to be superior to rubber for certain applications. Valuable for piston packing, because of the oil-tight seal provided. |

## *Review of Some Recently Developed Materials—Continued*

| Class of Material | Trade Name | Properties | Applications |
|---|---|---|---|
| Metal Alloy | **Kux Hi-Heat** | Non-oxidizing alloy, highly resistant to corrosion; dense, hard, and tough, taking a high permanent polish. Tensile strength, from 45,000 to 50,000 pounds per square inch; hardness, from 250 to 270 Brinell. | Suitable for use where resistance to heat and corrosion is required, as in creamery, dairy, and food-product equipment; also used for die-casting dies and synthetic plastic molds. |
| Rubber Product | **Laytex** | Highly flexible, high tensile strength, great resistance to compression, high dielectric strength, and important insulation properties. Has a stretch of 750 per cent and a tensile strength of 5000 pounds per square inch. | Especially suitable as an electrical insulation material, both because of its high dielectric strength and because it is not susceptible to moisture. |
| Copper Alloy | **Mallory 3** | Copper alloy possessing high strength. Elastic limit of rods, 50,000 pounds per square inch; ultimate strength, 70,000 pounds per square inch. Elastic limit of castings, 25,000 pounds per square inch; ultimate strength, 50,000 pounds per square inch. Castings have a high impact strength; retain high temperatures at about 775 degrees F. Impact strength does not fall below 50 foot-pounds. Forgings and drawn rods have an electrical conductivity of 80 to 85 per cent that of copper, and sand castings 75 to 85 per cent that of forged copper. Brinell hardness of bars and rods, 150 or greater; of sand castings, 116 to 125. | Used extensively for spot-welding tips, flash-welding dies, and seam-welding wheels, and for any other applications where a high-strength metal of high electrical conductivity is required. Obtainable in rods, bars, dies, drop-forgings, regular forgings, and sand castings; and in cold-drawn, swaged, cold-headed, or extruded parts. |
| Metal-coated Products | **Metal-Bord** | This material consists of thin sheets of metal bonded to cardboard or other backing materials, thus providing a sheet that has the appearance of metal, but is largely non-metallic. Obtainable in sheets up to 36 by 96 inches, with bright or satin finish. | Intended for use in constructing decorative panels, signs, advertising displays, and in manufacturing buttons, buckles, and dress ornaments. |
| High-speed Steel | **Mo-Max** | A steel containing 8 per cent molybdenum, 2 per cent tungsten, 4 per cent chromium, and 1 per cent vanadium. Comparable to high-tungsten steel without containing a high percentage of tungsten. Tools made from Mo-Max generally have greater hardness than those made from 18-4-1 high-speed steel, and equal or greater toughness. | Can be used for all types of tools for which regular tungsten high-speed steel is used; presents special advantages in machining work where difficulties have been encountered in using regular high-speed steel tools. |
| Nickel-chromium Steel | **Nikrome M** | An alloy steel containing from 2 to 2.5 per cent nickel; from 0.90 to 1 per cent chromium; and from 0.40 to 0.50 per cent molybdenum. Minimum guaranteed properties: Tensile strength, 110,000 pounds per square inch; yield point, 90,000 pounds per square inch; elongation in 2 inches, 16 per cent; reduction of area, 47 per cent. | This steel is especially intended for heavy-duty parts, such as axles, shafts, bolts, studs, etc., made to large dimensions—approximately from 5 to 8 inches in diameter. The material can be so heat-treated as to be practically uniform in hardness from the surface to the center. |
| Synthetic Plastic | **Plaskon** | A urea-base synthetic plastic molding material obtainable in all colors from white to lustrous black. Infusible and inflammable, tasteless, odorless, resistant to the action of grease and oils, and to the common organic solvents. Compressive strength, 25,000 to 35,000 pounds per square inch; tensile strength, 8000 to 13,000 pounds per square inch. | Used for practically all purposes where a synthetic plastic material might be applied, and especially where color is of importance. Covers and cases as large as 15 by 15 by 18 inches have been made. |

## *Review of Some Recently Developed Materials—Continued*

| Class of Material | Trade Name | Properties | Applications |
|---|---|---|---|
| Rubber-base Material | **Plioform** | Thermoplastic material which molds into relatively hard forms rapidly and without vulcanizing. Obtainable in almost any color, except very light shades. | Lends itself to the production of many decorative effects—plain, variegated, or mottled. Because of its comparatively low cost, is suitable wherever decorative effects are desired. |
| Rubber Lining for Tanks | **Plioweld** | A rubber lining material, about 3/16 inch thick, which provides effective protection against most corrosive liquids, hot and cold; does not oxidize nor crack or buckle under conditions of alternate drying and wetting. | Used for the protection of steel, aluminum, lead, or wooden tanks. A special adhesive derived from rubber actually "welds" the resilient rubber to the tank walls during the process of vulcanization. |
| Alloy Steel | **Prescoloy** | A nickel-alloy steel of high strength, especially developed for use in the railway field. | Used for cast nickel-steel railway trucks that weigh 13,000 pounds less than previous designs, but carry 26,000 pounds more load. |
| Synthetic Plastic | **Revolite** | Flexible form of laminated cloth or paper treated with Bakelite resinoid differing from the usual laminated sheets in that the flexibility is much greater. Laminations 1/8 inch thick can be bent over a 1/4-inch bar without cracking or splitting. | Among the applications are acid-proof linings; packing rings; transformer parts; vacuum-brake parts; gaskets; belting; upholstery for automobiles, trolley cars, buses, and airplanes; table covers, desk tops, etc. |
| Steel | **Silmo** | Steel having high-temperature strength combined with oxidation resistance. Tests show ultimate tensile strength at 85 degrees F. as 71,750 pounds per square inch; at 750 degrees F., 64,350 pounds per square inch. Elongation in 2 inches, between 35 and 36 per cent in both cases. At 1100 degrees F., the ultimate tensile strength is 35,600 pounds per square inch. | Used to replace regular carbon steel when greater safety is required at high temperatures or when oxidizing conditions are encountered. Suitable for use in the fabrication of cracking furnace tubes, pipe-still heater tubes, high-pressure boiler and superheater tubes, and tubes used in air-heating equipment. |
| Composite Stainless Steel | **Silverbond** | A product described as having a web-like structure of stainless steel in which inexpensive inserts of low-carbon steel are used to the extent of approximately 40 per cent, these inserts being firmly bonded to the stainless steel. The material is produced in round, flat, hexagonal, and octagonal bars, sheets, strips and special shapes. | Used where the outside surfaces must be corrosion-resisting. Now being applied in the manufacture of refrigerator trays and accessories, special shafting not requiring machining, and architectural and decorative trim. |
| Monel Metal | **S-Monel** | Corrosion-resistant material harder than regular Monel metal and offering greater resistance to wear and erosion, particularly steam erosion; is non-galling, especially at high temperatures. Tensile strength, 100,000 to 120,000 pounds per square inch; Brinell hardness, 275 to 350. | For use when regular Monel metal would be used, but when unusual hardness is required of a corrosion-resistant casting. |
| Cold-rolled Steel | **Stabilized Steel** | A steel retaining indefinitely the properties of temper-rolled steel, thus making prefabrication treatment unnecessary, even when the metal has been held in stock for some time. Resists cracking in unusually severe drawing operations. | Suitable for deep-drawing operations where uniformity and non-ageing characteristics are of value. Available in sheets and strips. |

## *Review of Some Recently Developed Materials—Continued*

| Class of Material | Trade Name | Properties | Applications |
|---|---|---|---|
| Free-machining Stainless Steel | **18-8 F M Stainless Steel** | A stainless-steel free-cutting alloy that can be satisfactorily turned, drilled, tapped, etc., and is obtainable in round, square, and hexagon bars and flat stock—annealed, pickled, cold-drawn, centerless-ground and polished. | Suitable for all purposes where a stainless steel is desired that has such qualities that it can be machined in much the same manner as regular carbon steel. |
| Metal Coating | **Sterilkote** | A synthetic coating for metals that is sufficiently adherent and elastic to permit bending, drawing, and other press operations without marring the finish. Applied to metal by spraying or "roller-coating" and then baked. | Recommended as a lining for beverage and food conveyors, since it is odorless, tasteless, and non-porous. Also recommended for metal surfaces subjected to hard usage such as washing-machine lids, dispensing cabinets, and laboratory equipment. |
| Synthetic Plastic | **Tenite** | A thermoplastic molding material obtainable both in sheet and granular form. Available in all colors and in sheets in thicknesses from 3/16 to 1 inch and in pieces as large as 20 by 25 inches. Has unusual strength. | May be used for all classes of molded plastics, especially for parts that may be subjected to temperatures up to 160 degrees F. and that must resist vegetable or mineral oils. |
| Thermostatic Bimetal | **Truflex** | Made in ten different types for temperature ranges of from —50 degrees F. to 1000 degrees F. Available in helical and spiral coils, rings, flat pieces, U-shapes, and in sheets up to 8 inches wide. It is made in thicknesses of 0.010 to 0.100 inch, varying by 0.005 inch. | Used for automatically controlling the operation of devices either heated or cooled by electricity, oil, or gas, as, for example, electric refrigerators, irons, toasters, gas ranges, water heaters, and domestic oil burners. |
| Alloy Steel | **Worthite** | Tensile strength, 67,000 to 75,000 pounds per square inch; yield point, 30,000 to 35,000 pounds per square inch; elongation in 2 inches, 35 to 45 per cent; reduction in area, 35 to 45 per cent; Brinell hardness, 125 to 150. Resistant to sulphuric acid and to weak muriatic acid, but should not be used for very hot sulphuric acid above 50 per cent concentration, nor for halogen acids, except very weak solutions. | A high-nickel, high-chromium molybdenum alloy steel suitable for all purposes where chromium-iron alloys or nickel-chromium stainless steels are applicable, and, in addition, for purposes where its ability to resist sulphuric acid is of especial value. |
| Wrought Iron Containing Nickel | | The addition of about 3 per cent nickel to wrought iron increases the yield point about 50 per cent and the tensile strength about 25 per cent. A 3 per cent nickel wrought iron has a yield point of 45,000 pounds per square inch and a tensile strength of 60,000 pounds per square inch. Nickel improves the hardness and increases the impact strength. Can be welded successfully by either the oxy-acetylene or electric-arc methods; can be easily machined. | Used for pump socket rods subjected to severe corrosive conditions and high stresses. Field tests show that nickel wrought iron has a service life many times greater than that of other commercially used materials. Other applications are in the manufacture of chain, staybolts, engine bolts, drawbars, boilers, and ship-plates. |
| Corrosion-resisting Alloy Steel | **Yoloy** | A nickel-copper alloy steel produced in sheets, strips, bars, plates, shapes, wire, and seamless pipe. Has exceptional resistance to corrosion, high tensile strength, high ductility, workability, and weldability. Low-strength Yoloy has a tensile strength of 74,000 pounds per square inch; high-strength Yoloy, 92,000 pounds per square inch. | For use where resistance to corrosion is essential, where abrasion must be withstood, and where long life is desired for the same weight of material, or equal life with lighter weight. |

# Gear Manufacturers Meet on Board Ship

**The Nineteenth Semi-Annual Meeting of the American Gear Manufacturers' Association, Held on Board the S. S. Seeandbee while Sailing the Great Lakes, Covered a Wide Range of Mechanical and Business Subjects**

WHILE sailing on the Great Lakes from Chicago to Cleveland, the American Gear Manufacturers' Association held its regular semi-annual meeting September 8 to 10, on board the largest of lake steamers, the well-known S. S. *Seeandbee*. The meeting was well attended and the program was filled with the usual large number of important technical papers and committee reports characteristic of this association.

E. S. Sawtelle, President of the A.G.M.A., and President of the Tool Steel Gear & Pinion Co., Cincinnati, Ohio

Aside from the address of the president, E. S. Sawtelle, which touched upon the important subjects now facing the Association and industry, five papers were read on engineering and business subjects as follows: "Designing High-Speed Gears for Quiet Operation," by W. P. Schmitter, of the Falk Corporation, Milwaukee, Wis.; "Increasing Our Earnings," by J. H. Jackson, of the Pittsburgh Gear & Machine Co., Pittsburgh, Pa.; Eliminating Waste," by T. H. Owens, of the Westinghouse Electric & Mfg. Co., East Pittsburgh, Pa.; "Recent Developments in Bevel and Hypoid Gearing," by A. H. Candee, of the Gleason Works, Rochester, N. Y.; and "Relations between Load Rating and Design Stresses of Gear Units," by C. B. Connell, of the Nuttall Works of the Westinghouse company.

In his paper, "Increasing Our Earnings," Mr. Jackson pointed out that industry in general, including the gear manufacturing industry, faced the problem of further increases in production costs, due to five specific causes:

1. Encouragement given to labor by federal and local governments to demand and obtain higher wages.

2. Natural and artificial causes that have increased the cost of food and clothing.

3. Monetary policies of the Federal Government, which, although reacting more slowly than the Government expected, are now beginning to influence the general price level of all products.

4. Continued high level of taxes. The Social Security taxes will in reality add 9 per cent to payrolls. Sales taxes, capital stock taxes, real estate taxes, and many others can be expected to rise.

5. Restrictive legislation, such as the Walsh-Healy Government Contracts Act and the Patman-Robinson Anti-Price Discrimination Act, which naturally add to the cost of doing business—if in no other way, because of the fees to be paid to lawyers to try to find out what the laws mean.

In addition to the papers regularly presented by members before the meeting, two papers of unusual interest that had previously been presented before meetings of other associations, were read in abstracted form. These were "Industry's Contribution to Civilization," by S. Wells Utley, president of the Detroit Steel Castings Co., and "We are on Our Way—to What?" by Charles R. Hook, president of the American Rolling Mill Co. Both of these papers proved of unusual and thought-provoking interest at the present time.

* * *

Motorists as a class pay, in taxes connected with the purchase and use of automobiles, one out of every eight dollars collected by the federal, state, and local governments. The total motor vehicle taxes last year amounted to $1,286,000,000.

## A New Mechanism Book—Second Volume of Ingenious Mechanisms

INGENIOUS MECHANISMS FOR DESIGNERS AND INVENTORS—VOLUME II. Edited by Franklin D. Jones. 538 pages, 6 by 9 inches; 303 illustrations. Published by THE INDUSTRIAL PRESS, 140-148 Lafayette St., New York City. Price, $5.

This second volume of Ingenious Mechanisms for Designers and Inventors is a companion book to Volume I which is well known to many engineers and machine designers here and abroad. Each volume is an entirely independent treatise, and both combined form a comprehensive encyclopedia of mechanical movements. The 303 illustrations or drawings in Volume II show mechanisms differing in design from those shown by the 300 illustrations in Volume I. Both volumes, however, contain a number of chapters dealing with mechanisms of the same general type. For example, in Volume I, Chapter 1 is on Cams and Their Application, and the twenty-one types and designs shown are supplemented in Chapter 1 of Volume II by thirty additional cam-operated mechanisms.

The seventeen chapters or sections in Volume II deal with the following subjects: Cam Applications and Special Cam Designs; Intermittent Motions from Gears and Cams; Intermittent Motions from Ratchet Gearing; Intermittent Motions of Geneva Type; Tripping or Stop Mechanisms; Overload Relief Mechanisms and Automatic Safeguards; Reversing Mechanisms of Special Design; Drives of Crank Type for Reciprocating Driven Members; Reciprocating Motions Derived from Cams, Gears, Levers, and Special Mechanisms; Speed-changing Mechanisms; Speed Transmissions and Over-running Clutches; Self-centering Pivoted Levers and Sliding Members; Multiple-lever Mechanisms with Dwelling or Idle Periods, and Other Special Lever Combinations; Feeding Mechanisms and Auxiliary Devices; Feeding and Ejecting Mechanisms for Power Presses; Miscellaneous Mechanical Movements; and Valve Diagrams.

The illustrations and descriptions are confined to the important elements or units found on various types of automatic machines and other mechanical devices. For example, in the chapters dealing with intermittent motions, stop mechanisms, reversing mechanisms, overload relief mechanisms, speed-changing mechanisms, and so on, the descriptions relate only to the actual devices or units that perform these different functions.

These various unit mechanisms or mechanical devices have actually been applied to a great many different types of automatic machines and other mechanical appliances, and these two books provide a very complete course of study. All of the mechanisms described in each book are grouped, as far as possible, into chapters according to general types, which, in addition to the complete index for each book, greatly facilitates finding whatever class of mechanical movement is desired. This arrangement also brings together many mechanisms which are alike as to function and purpose, but differ entirely in design; consequently, such mechanisms can readily be compared. These books will enable any designer or draftsman to acquire an expert knowledge of the general subject of mechanism, and every mechanism shown embodies some idea or principle likely to prove useful to designers and inventors.

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## Sixty-Six Years with One Company and Still Going Strong

Sixty-six years ago, at the age of twelve, George Metzger began to work in the plant of Henry Disston & Sons, Inc., Philadelphia, Pa. He was first a general utility boy, then a helper in the blacksmith shop, then a blacksmith, then foreman, and later superintendent of blacksmith work. For more than thirty years, many of the dies and tools used in the Disston plant were treated under his supervision.

Upon completing his sixty-sixth year with the Disston plant, Mr. Metzger was presented with an engrossed resolution passed by the company's board of directors in appreciation of his services. In addition, he received a check from the company and a pipe, since he prefers a pipe and scorns cigars. In spite of his seventy-eight years, he is unusually active. He spends his summer week-ends swimming and diving.

* * *

The Government never really goes into business, for it never makes ends meet; and that is the first requisite of a business. The Government just mixes a little business with a lot of politics, and no one ever gets a chance to find out what is actually going on.—*Thomas A. Edison*

*George Metzger Receiving an Engrossed Copy of a Resolution of Appreciation from the Board of Directors of Henry Disston & Sons, Inc., Upon the Completion of Sixty-six Years of Continuous Service with the Company*

# NEW TRADE LITERATURE

***Recent Publications on Machine Shop Equipment, Unit Parts, and Materials. Copies can be Obtained by Writing Directly to the Manufacturer.***

## Alloy Steels

CARPENTER STEEL CO., Reading, Pa. Publication entitled "Alloy Steels Simplified," containing definite, condensed information on the application and use of alloy steels. The following subjects are dealt with in a concise manner: Why Do We Use Alloy Steels?; Which Alloy Steels Should be Used?; Choosing between a Casehardening and a Tempering Steel; the Two Casehardening Alloy Steels; the Two Tough Tempering Alloy Steels; the Two Hard Tempering Alloy Steels; and Why Chrome-Nickel Alloy Steels are Chosen. In addition, complete information and instructions for forging, normalizing, annealing, hardening, drawing, etc., of the various Carpenter alloy steels are given.

## Synthetic Plastics

BAKELITE CORPORATION, 247 Park Ave., New York City. Catalogue (seventh edition) on Bakelite Molded, describing in detail the characteristics, properties and infinite number of applications of this material in various fields of industry. A brief description of the molding process and required equipment is included. The many illustrations showing examples of products made from Bakelite Molded should be of suggestive value to designers.

## Chromium-Plating for Machine Parts and Dies

MASTER CHROME SERVICE, INC., 5609 Herman Ave., N.W., Cleveland, Ohio. Booklet describing the chromium-plating process and its application to machine parts and dies. The physical properties of chromium are described and new uses that are being developed for hard chromium-plating are pointed out. A standard scale giving the cost of chromium-plating for different classes and sizes of work is included.

## Collapsible Taps

LANDIS MACHINE CO., INC., Waynesboro, Pa. Operator's Instruction Book on Landis collapsible taps, giving detailed data covering the Landis Style LT collapsible taps for straight threads and Style LM receding-chaser collapsible taps for tapered threads. It gives instructions for grinding the tap chasers and for operating the collapsible taps, as well as general instructions.

## Adjustable Reamers

WETMORE REAMER CO., 424 N. 27th St., Milwaukee, Wis. General catalogue covering the Wetmore line of adjustable reamers. Several additions to the line are shown in this catalogue for the first time. The distinctive features of these reamers are described and price lists for the various types are given. Data is included on a variety of special tools.

## Roller Bearings

TIMKEN ROLLER BEARING CO., Canton, Ohio. Booklet entitled "Maintenance and Lubrication of Bearings in Rolling Mill Equipment," discussing in detail the recommended practice for assembling Timken bearings of various types, their repair, adjustment, and lubrication. A convenient chart is included for keeping track of bearing use and life.

## Electric Welding Machines

EISLER ENGINEERING CO., 749 S. 13th St., Newark, N. J. Booklet 36-AC, entitled "Weld it with Eisler Alternating-Current Arc Welders," describing the special features of the different types of arc welding machines made by this concern, including stationary and portable types and dual-control machines. Typical operating costs are given.

## Power Presses

CLEARING MACHINE CORPORATION, 6499 W. 65th St., Chicago, Ill. Catalogue descriptive of the Clearing line of crankless steel power presses, which are made in single-, double-, and triple-action types. Catalogue descriptive of Clearing crankless single-action power presses, which are built in one-, two-, and four-point suspension types.

## Drilling Machines

BARNES DRILL CO., 814 Chestnut St., Rockford, Ill. Booklet entitled "Self-Oiling All-Geared Drilling Machines, Standard and Special, for Lower Costs and Higher Production," containing many illustrations and information on various applications of these machines, including drilling, boring, reaming, tapping, honing, facing, etc.

## Jig-Boring Machines

SOCIETE GENEVOISE D'INSTRUMENTS DE PHYSIQUE, Geneva, Switzerland (American agent, TRIPLEX MACHINE TOOL CORPORATION, 125 Barclay St., New York City.) Catalogue 633, describing the constructional features of the latest design of Societe Genevoise high-speed jig boring machines and their application.

## Heat-Treating Equipment

LEEDS & NORTHRUP CO., 4921 Stenton Ave., Philadelphia, Pa. Circular entitled "How Marlin-Rockwell Tempers Steel Balls," describing the use of the Leeds & Northrup Homo tempering furnace for tempering balls for ball bearings in the plant of the Marlin-Rockwell Corporation.

## Equipment for the Process Industries

EDGE MOOR IRON WORKS, 30 Rockefeller Plaza, New York City. Bulletin 101, descriptive of special equipment for the processing industries fabricated from steel, stainless steel, aluminum, Monel metal, nickel, "Everdur" and "Ni-clad."

## Aluminum Alloy

APEX SMELTING CO., 2554 Fillmore St., Chicago, Ill. Bulletin 1, describing Apex 400 alloy—a high-strength, light-weight aluminum alloy, non-corrodible in the atmosphere, in sea

water, and in many acids, and adapted to sand, die, and permanent mold castings.

### Milling Machines

CINCINNATI MILLING MACHINE CO., Cincinnati, Ohio. Circular illustrating and describing the new Cincinnati MH plain and universal milling machines, which are designed for small to average size work-pieces, run in tool-room or job-lot quantities.

### Synthetic Plastics

GENERAL PLASTICS, INC., North Tonawanda, N. Y. Catalogue containing information on Durez Resins for impregnating metal castings and many other materials, as well as for general bonding, coating, insulating, waterproofing, etc.

### Nickel-Alloy Steels

INTERNATIONAL NICKEL CO., INC., 67 Wall St., New York City. Bulletin P-1, entitled "The Properties and Applications of Heat-Treated Wrought Nickel-Alloy Steels in Sections up to About 6 Inches in Diameter or Thickness."

### Thread-Grinding Machines

JONES & LAMSON MACHINE CO., Springfield, Vt. Catalogue illustrating and describing the features of construction of the Jones & Lamson automatic thread grinding machine which is equipped with an automatic truing device.

### Pipe Threading and Cutting Tools

BEAVER PIPE TOOLS, INC., Warren, Ohio. Catalogue 37, covering the complete line of Beaver pipe tools, including all the new and improved designs produced since 1929. A new price list has been issued in connection with this catalogue.

### Screw Steel

UNION DRAWN STEEL CO., Massillon, Ohio. Circular entitled "Union Free Cut (S A E 1112)—The Reliable Bessemer Screw Steel," describing the development and advantages of this type of cold-drawn steel.

### Electric Equipment

MARTINDALE ELECTRIC CO., Cleveland, Ohio. Catalogue 20, covering the line of electric maintenance equipment for motors and commutators, as well as mechanical maintenance equipment and safety-first equipment.

### Variable-Speed Transmissions

REEVES PULLEY CO., Columbus, Ind. Circular illustrating some of the many different controls for use with Reeves variable-speed transmissions, including manual, electric, mechanical automatic, hydraulic, and differential.

### Pumps

WORTHINGTON PUMP & MACHINERY CORPORATION, Harrison, N. J. Bulletins illustrating and describing horizontal simplex air and steam heating vacuum pumps and Monobloc centrifugal pumps.

### Cleaning Metal Parts

AMERICAN FOUNDRY EQUIPMENT CO., Mishawaka, Ind. Folder 33, illustrating and describing the Wheelabrator multi-rotary table—an airless abrasive method of cleaning fragile or intricate metal parts.

### Gear-Shaping Machines

FELLOWS GEAR SHAPER CO., Springfield, Vt. Circular describing the construction and operation of the new Fellows No. 4 enveloping gear generator for finishing spur and helical external and internal gears.

### Electric Controlling Apparatus

ALLEN-BRADLEY CO., 1331 S. First St., Milwaukee, Wis. Circular describing the Bulletin 709 automatic solenoid starter, which embodies some entirely new features of design.

### Drying Machines

LINK-BELT CO., 300 W. Pershing Road, Chicago, Ill. Circular illustrating and describing the Link-Belt rotary louvre dryer for drying all types of granular materials.

### Clutches

CONWAY CLUTCH CO., 1534 Queen City Ave., Cincinnati, Ohio. Bulletin L-28, containing tabulated data covering the different types and sizes of Conway large-size disk clutches.

### Motor-Driven Drilling Units

AVEY DRILLING MACHINE CO., Cincinnati, Ohio. Circular descriptive of the Avey motor-driven drilling units, which may be used singly or in groups to increase production.

### Ball Bearings

AHLBERG BEARING CO., 317 E. 29th St., Chicago, Ill. Circular containing data, including list prices, on Simplex ball-bearing machine units for machine applications.

### Motorized Speed Reducers

JANETTE MFG. CO., 556 W. Monroe St., Chicago, Ill. Bulletin 22-10, illustrating various types and sizes of motorized speed reducers and giving essential data.

### Saw Sharpening and Knife Grinding Machines

NORTON CO., Worcester, Mass. Bulletin descriptive of the use of saw sharpening and knife grinding equipment in saw mills.

### Fractional-Horsepower V-Belts

B. F. GOODRICH CO., Akron, Ohio. Catalogue Section 2180, describing the complete line of "Longlife" fractional horsepower V-belts made by this company.

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## B & S Mutual Relief Association Fifty Years Old

On September 10, the Brown & Sharpe Mutual Relief Association observed the fiftieth anniversary of its founding. During this half-century, it has paid to members $455,117 in sick benefits and, over the last twenty-seven years, $63,600 in death benefits.

At the present time, 82 per cent of the company's employes are members of the Association. They elect their own officers and manage the Association's business. All overhead or operating expense is donated by the Brown & Sharpe Mfg. Co., which also gives as an annual donation a percentage of the total benefits paid to the members. David Arnott is president of the organization, and has served in that capacity for more than sixteen years. Thirty men in various capacities throughout the plant comprise the board of directors.

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## A New Type of Drill Gage

The National Twist Drill & Tool Co., Detroit, Mich., has devised a new drill gage which measures, at one end, the conventional 118-degree point, and at the other, the 135-degree point which has come into common use of late. Information is also given on the gage as to the proper clearance and chisel point angles for the drill point angles given. The gage is made from stainless steel to withstand corrosion, and is available upon application to the National Twist Drill & Tool Co.

# *Shop Equipment News*

*Machine Tools, Unit Mechanisms, Machine Parts, and Material-Handling Appliances Recently Placed on the Market*

## Oilgear Cyclematic Broaching Machine

The largest Cyclematic broaching machine ever built by the Oilgear Co., 1310 W. Bruce St., Milwaukee, Wis., was recently constructed for broaching the bores of dynamo yokes at a production rate of 300 yokes per hour. Two yokes are broached simultaneously. The over-all height of this machine is 15 feet 7 inches; the width, 5 feet 8 inches; and the depth, front to back, 7 feet 8 inches. The normal operating capacity is 80,000 pounds, and the peak capacity 120,000 pounds. The maximum stroke is 54 inches, and the cutting speed is variable from 5 to 30 feet a minute.

The machine is similar in design and operation to the smaller model described in January, 1932, MACHINERY, page 376. In the operation for which the new machine is equipped, as shown in the heading illustration, all the operator has to do is load the two parts on the carriage table and then trip the foot-pedal. The entire broaching operation, the handling of the tools, and the ejection of the work are accomplished automatically.

When the starting pedal is depressed, the broaches descend and their lower ends engage mechanically locking sockets. The descending ends of the broaches serve to accurately centralize the work. The table next rises automatically and draws the work upward over the broaches. Near the top of the stroke, the broaches are disengaged from their upper sockets, and as the table completes its movement, the work clears the broach shanks. The work is then mechanically ejected on a false table. As the carriage is lowered to the loading position, the false table is tilted, thus automatically unloading the work.

Fig. 1 shows four of the broaching tools used on this ma-

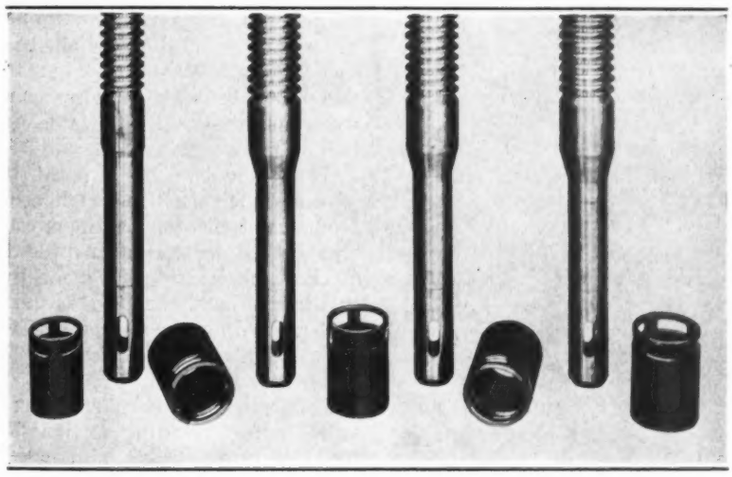


Fig. 1. Starting Ends of Four Broaches and Work Broached on Machine Shown in Heading Illustration

chine and the parts broached by them. These yokes are formed of hot-rolled strip steel welded together. The large yokes are 3 7/8 inches in diameter inside, and have a wall thickness of 11/32 inch. Yokes vary in length from 6 to 7 1/16 inches. There are fifty-two teeth on the broaching tools which are 58 inches long and remove approximately 0.035 inch of stock from the yokes. The largest broaching tool weighs 260 pounds.

There are four notches on the top end of each tool which are engaged by a detent attached to the upper tool-holder cross-head which holds the tools in place during the loading operation and during the major portion of the broaching stroke. The lower end of each broach is provided with a slot through which a key is automatically inserted to hold the tool in position during the broaching operation. The broaching teeth of each tool are made in sections, so that the roughing section can be discarded when worn and the other sections moved forward.

The pump, 75-horsepower electric motor, piping, valves, and control mechanism are all mounted inside the frame, which is of welded-steel construction. The machine weighs 30,000 pounds.

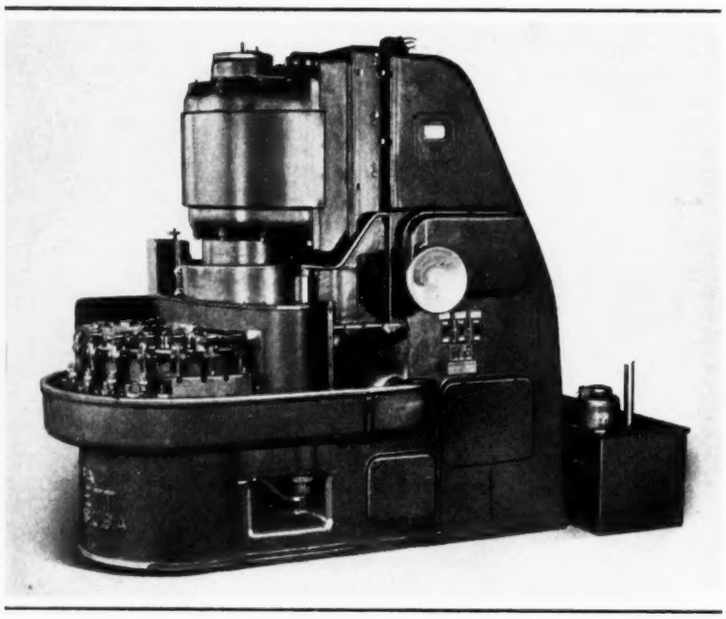
## Hanchett Rotary Surface Grinder

A surface grinder of the vertical-spindle type weighing 17,000 pounds was recently built by the Hanchett Mfg. Co., Big Rapids, Mich., for the continuous finishing of work. In the illustration, this machine is shown set up for grinding the boss faces of automobile connecting-rods. The grinding head is driven by a 30-horsepower built-in motor which runs at 900 revolutions per minute. The motor is fully enclosed and is ventilated by a fan.

The wheel-head can be fed downward either by hand or automatically. With the power feed, a two-horsepower motor is used for rapid raising and lowering. The grinding wheel is 20 inches in diameter, 3 or 4 inches high, and has either a 2- or a 3-inch face. The wheel may be of the cylinder type or of the segmental type. The work-table is 36 inches in diameter and can be operated at any speed from 1/2 revolution to 1 1/2 revolutions per minute. It is driven through a Transitorq variable-speed unit, direct-connected to a two-horsepower motor. This unit is mounted on the left-hand side of the machine. A 36-inch rotary magnetic chuck can be supplied.

There is a wheel-dresser built into the machine which is operated by means of the handle on the right-hand side. An automatic sizing device compensates for wheel wear, and an ammeter registers the performance of the driving motor.

The coolant system comprises a Ruthman motor-driven centrifugal pump, mounted in a tank at the rear, which has a capacity for 150 gallons of coolant. The pump discharges at the rate of 90 gallons a minute. The coolant is delivered to the grinding wheel and the work in the center of the wheel. Auxiliary nozzles carry the coolant to the work from the outside of the wheel. All electrical controls are located within the column.



Hanchett Rotary Surface Grinder Arranged for the Continuous Finishing of Connecting-rod Bosses

## Oliver Improved Belt Grinder and Polisher

Flat work up to 46 inches long by 26 inches wide can be supported directly on the table of an improved belt grinding and polishing machine being placed on the market by the Oliver Machinery Co., Grand Rapids, Mich., and ground or polished in one setting. Wider work can be accommodated by moving the work sidewise on the table in two or more settings.

The table can be lowered to give as much as 9 inches height from the table top to the abrasive belt. Vertical adjustments of the table are readily made by turning a handwheel to actuate a 4-inch diameter screw. The table has a sidewise travel of 29 inches.

This machine is particularly suitable for grinding or polishing aluminum, brass, and other castings, bronze tablets, etc. Provision can be made for either wet or dry grinding.

## Brown & Sharpe Plain Milling Machine

Full electrical control of all table and spindle power movements is a feature of the No. 10 plain milling machine recently added to the line of the Brown & Sharpe Mfg. Co., Providence, R. I. This machine is designed especially for the rapid manufacture of small parts on either long or short runs. The range of sixteen spindle speeds—from 55 to 1800 revolutions per minute—permits the efficient machining of materials varying from tough alloy steels to free-cutting brass and aluminum.

A wide variety of automatic milling cycles can be used, and owing to the control system employed, the tripping action is unusually rapid and sensitive. Thus stopping and reversing of the table can be accurately controlled. The table has a feed of 12 inches, while the vertical knee adjustment is 11 1/2 inches, and the transverse adjustment of the spindle 2 inches.

The spindle, table, and coolant pump are driven by separate direct-connected constant-speed motors. The table motor, and hence the table itself, is stopped or reversed quickly by reversing the current. The spindle motor is stopped in the same manner, and, in addition, it is equipped with an integral electrically controlled mechanical brake for holding the spindle stationary, so as to prevent marking work with rotating cutters and to facilitate cutter replacement.

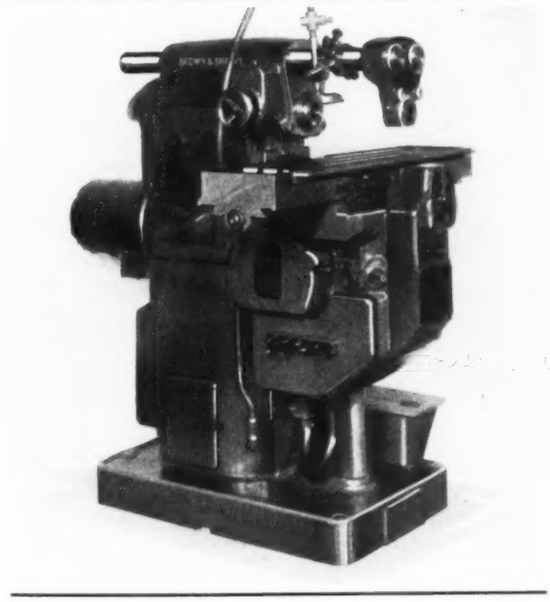
The automatic power movements are governed by adjustable table dogs through a control unit mounted on the front of the knee. There is also a manual control in the same unit by means of push-buttons, including a button for instantly stopping the table and a spindle jog button for facilitating spindle setups. A control switch permits the spindle to start and stop with the table, to rotate during the cutting feed only, or to run continuously, independently of the table movement, as desired. Another switch permits the spindle to rotate in either direction or to be inoperative. A safety switch provides for instantly stopping the table and spindle.

The entire table driving mechanism, including the motor, is built compactly into the knee. In addition to sixteen feeds ranging from 1/2 inch to 20 1/2 inches per minute, a fast table movement of 300 feet per minute in either direction is available.

## Geist Improved Roller Pipe-Cutter

The shaft that carries the disk cutter on the No. 4 Geist roller pipe-cutter, marketed exclusively by the Landis Machine Co., Inc., Waynesboro, Pa., is now mounted in Timken roller bearings. Bronze-bushed bearings were used heretofore. This improvement provides a stronger construction, insures longer life of the equipment, and eliminates the necessity of making frequent adjustments to compensate for wear.

Other advantages derived from the increased rigidity of the mounting and the precise alignment obtained between the cutter-shaft and the rollers include reduced cutting-off time, less burr thrown up on the pipe, and increased life of the disk cutter. This machine has a capacity for pipe from 1/4 to 4 inches.



B & S Milling Machine with Full Electrical Control of All Table and Spindle Power Movements

Geist Roller Pipe-cutter Now Equipped with Timken Roller Bearings

## Bausch & Lomb Metallographic Outfit

A research metallographic outfit recently developed by the Bausch & Lomb Optical Co., 619 St. Paul St., Rochester, N. Y., is provided with complete equipment for working with bright-field polarized light and with a dark field. The magnifying range is from a low limit of 2.5X to the highest magnification possible with an oil-immersed objective and high-power eyepieces.

This equipment consists of inverted microscope units; an illuminating system which includes either a motor-driven arc lamp and resistance for use with direct current or a tungsten arc lamp for use with alternating current; an 8- by 10-inch camera provided with front and rear metal supports and a bar that is graduated to give bellows readings direct; a supporting bed that carries extension focussing rods on both sides for coarse and fine adjustment of the microscope; a stand with adjustable shock absorbers; a cabinet for accessories and plate-holders; and a cushioned stool that is adjustable for height.

The circular stage of the instrument is 6 inches in diameter, the circumference being graduated in degrees. The top plate of the stage is adjustable 1 inch in two directions at right angles to each other, thus permitting rotation of the specimen on center, which coincides with the field of the objective.

The new type of vertical illuminator provided serves not only for bright field work, but also as an analyzer and polarizer for polarized light work. From the standpoint of the amount of initial illumination transmitted to the object, the efficiency of this illuminator is several times that of the conventional clear-glass or prism type.

The dark-field illuminator is a glass cube with a central stop mounted in a rotary turret with the vertical illuminator prism. This permits a rapid change from a bright field or polarized light to a dark field without disturbing the focus of the objective.

Six objectives and ten eyepieces are available to provide a full range of the standard magnifications required in metallographic work. Another feature is a new photomicrographic lamp developed to give an intensity of approximately 2 1/2 times that of any existing concentrated homogeneous light source. This lamp is supplied in a housing that is interchangeable with the housing of the arc lamp.

## National Centrifugal Oil Extractors and Dryers

A line of improved oil extractors and dryers designed to meet the requirements of manufacturers who do not require more highly developed equipment is being announced by the National Separator Co., subsidiary of the Leon J. Barrett Co., Worcester, Mass. These dryers and extractors are similar in appearance, but have different methods of directing the air flow from the center of the basket through its contents at high velocity. Also, in the case of the extractor, a pan, such as seen in the illustration, is supplied for holding the chips, whereas the dryer is supplied with a suitable basket.

Metallographic Outfit for Working with Bright-field Polarized Light or with a Dark Field

Improved Centrifugal Oil Extractor Brought out by the National Separator Co.

These machines are built in two types. There is a spindle-post machine, in which the pan is furnished with a center sleeve post that telescopes over the spindle of the machine. The latter passes through a hole in the cover. The upper end of the spindle is threaded and fitted with a nut which holds the cover against the top of the pan. The other type of machine is made without the spindle post. Instead, a rim locking device is provided for holding the cover to the top of the pan. This type of machine is best suited for handling long curly chips.

A feature of these machines is a horizontal motor drive which transmits power through a compensating shaft. A single pulley drive can also be supplied. These machines are built in various sizes having a load capacity ranging from 400 to 9000 cubic inches. The oil extractor pans range in top diameter from 14 1/2 to 30 inches, and in depth from 3 1/2 to 17 1/2 inches.

## Hardinge Precision Vertical Milling Machine

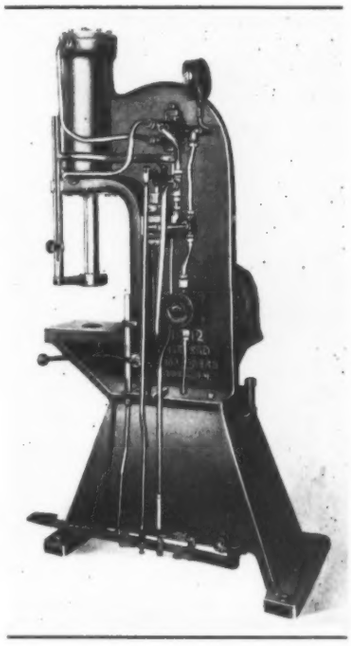
One of the new exhibits of Hardinge Bros., Inc., Elmira, N. Y., in Booth L-14 at the National Metal Exposition will be a Cataract precision vertical milling machine with a ball-bearing spindle construction to suit high speeds. This machine is designed for bench mounting, and is of modern appearance.

Intricate milling operations on small parts can be performed on this machine in a comparatively simple manner. While the illustration shows a vise on the table, index-heads, tailstocks, swivel bases, universal adapters, right-angle bases, lever feed arrangements, and routing attachments are also available. The spindle construction embodies precision preloaded ball bearings of the double row type, which provide maximum rigidity with minimum friction. They overcome the radial and end play that are sometimes detrimental to milling operations.

The machine is fully enclosed, including the driving belts to the spindle, so as to exclude dirt and chips. An electrical driving unit is mounted under the bench on which the machine is installed, which provides eight spindle speeds up to 5000 revolutions per minute. The two levers on the left-hand side of the machine provide for convenient operation of electrical switches that control low, high, forward, and reverse spindle speeds, as well as stopping of the spindle.

The important dimensions of this machine are as follows: Size of table working surface, 12 by 3 1/4 inches; longitudinal, transverse, and vertical travel of table, 5 7/8, 3 3/8, and 5 3/4 inches, respectively; and bench space occupied, 23 by 22 inches. The vertical head has a 1/2-inch collet, while the index-heads have 1/2- or 3/4-inch collets.

Hardinge Precision Vertical Milling Machine with Ball-bearing Spindle Construction



Hydraulic Press for Assembly and Straightening Operations

## Greenerd Hydraulic Ball-Bearing Assembly Press

A Greenerd 15-ton hydraulic press designed especially for assembling ball bearings in conjunction with suitable fixtures is a recent product of the Edwin E. Bartlett Co., Nashua, N. H. This machine is also particularly adapted for straightening work when it is equipped with a special table.

The press is operated through a foot-treadle, the pressure exerted by the ram being controlled by the amount of pressure applied to the treadle. The pressure may be controlled evenly through the foot-treadle or by locking the vertical operating rod by means of the hand-lever. When the rod is locked, the pressure will remain uniform until the hand-lever is tripped. The ram is then returned automatically to a power stop which may

be set to any predetermined point to suit the work.

This press will handle work up to 18 inches in diameter. The height over the table with the ram up is 16 inches, and the stroke is adjustable from 0 to 16 inches. The speed of the ram on the down stroke is 36 inches a minute.

## "Do-All" Machine with Extra Deep Throat

A throat 25 inches deep from the saw or file band to the face of the column is a feature of the Model JXD "Do-All" continuous sawing and filing machine recently designed by the Continental Machine Specialties, Inc., 1301 Washington Ave., S., Minneapolis, Minn. As with previous models described in MACHINERY, this machine is adapted for both precision internal and external sawing and filing. The table area is 22 by 30 1/2 inches.

The table and frame are heat-treated nickel-iron castings. The third idler wheel can be tilted in the same manner as the main upper wheel to permit accurate tracking of the blade. The machine can, however, be operated without using the third idler wheel when handling jobs that do not require the full capacity of the deep throat. To obtain the long file band necessary on this machine, an extension is coupled to the standard file band.

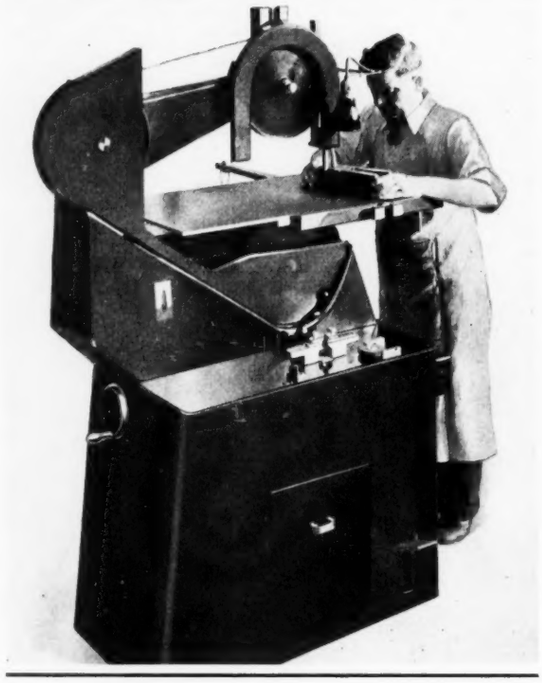
## Bliss-Consolidated Inclinable Press

The E. W. Bliss Co., Brooklyn, N. Y., has recently added a heavy-duty adjustable-stroke inclinable press to the Bliss-Consolidated line built by the Consolidated Press Division, Hastings, Mich. This press, as here shown, is single-geared and arranged for a direct-connected motor drive, but it can be arranged for non-geared operation in special cases. Jaw and fast-rolling key clutches of improved design are available to suit service requirements. Timken roller bearings and bronze-bushed main and crankpin bearings reduce friction to a minimum.

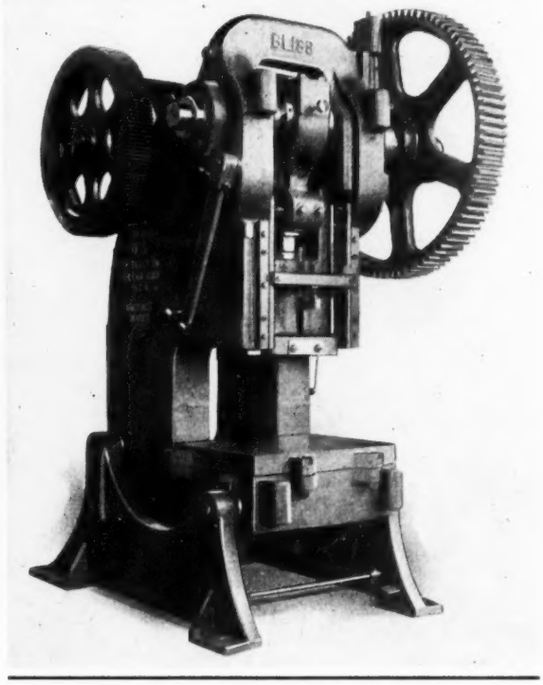
The stroke is adjustable to 2, 4, and 6 inches. There is a die space of 19 inches with a 2-inch stroke, 18 inches with a 4-inch stroke, and 17 inches with a 6-inch stroke. The adjustable eccentric is locked rigidly by means of a patented rolling key device. This adjustment is unusually easy and convenient. When geared, the press operates at the rate of forty strokes a minute.

## Remco Motor Drives for Machine Tools

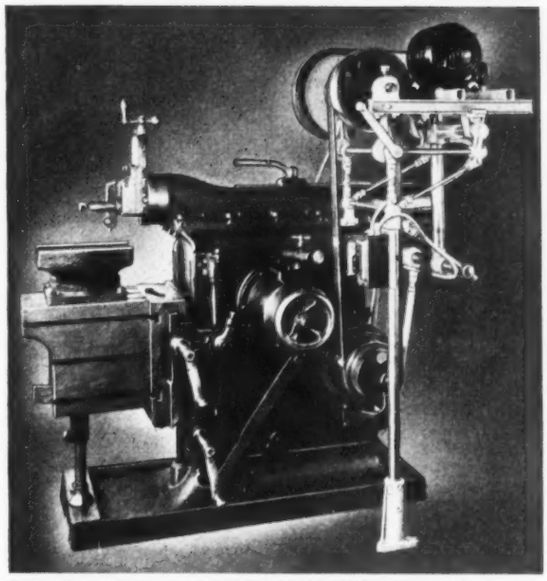
Machine tools of older types that are being driven from line-shafts in shops and vocational schools can be conveniently modernized through the application of Remco individual motor drives, as in the case of the shaper here illustrated. These



"Do-All" Machine with Throat Depth of 25 Inches




Bliss-Consolidated Inclinable Press with Adjustable Stroke



Remco Modernizing Motor Drive Applied to a Shaper

DeWalt Metal-cutting Machine for Light-section Materials

motor drives can be supplied by the Manley Products Corporation, York, Pa., for drilling, milling, and hacksawing machines; engine lathes; shapers; and other machine tools.

The structure of each drive is supported by a round column which can be connected to the machine itself or inserted in a floor socket, as shown. Triangular truss members insure rigidity of the structure. The motor rails are adjustable to suit various sizes and makes of motors.

In addition to the efficient transmission of power, these drives provide greater headroom, permit better lay-out of shop equipment, and reduce accident hazards.

## DeWalt Automatic Metal-Cutting Machine

A metal-cutting machine designed to handle all light-section materials that can be cut with saw blades is a recent development of the DeWalt Products Corporation, 35 Fountain Ave., Lancaster, Pa. After the stock has been started manually into the feed jaws of the machine, it is automatically pushed against a length stop, clamped simultaneously on both sides of the saw kerf by a four-jaw vise, and cut off. The saw then recedes, the stop is lifted, and the feed mechanism pushes another section of the stock into the vise, displacing the piece cut off, after which the cutting-off cycle is repeated.

The machine illustrated was designed primarily for handling light-wall tubing. It will cut off tubing 2 inches in diameter by 6 inches long, for example, at the rate of 28 pieces a minute, which is an average of one cut in a little more than two seconds. This machine is equipped with a 16-inch hollow-ground saw blade, driven at a speed of 3600 revolutions per minute by a 7 1/2-horsepower motor. All mechanical movements of the machine, except the driving of the saw blade, are actuated by a one-horsepower motor which drives through a variable-speed V-belt pulley. A slip clutch furnishes a convenient control of the machine action.

The saw motor is fed along the overhead arm by means of a simple double crank, there being an adjustment for the forward position of the saw blade in relation to the material to be cut off. The stock is fed into the automatic vise by means of a crank that operates through a cross-head to give a straight-line movement. The length of the feed movement is controlled by the throw of the crank, the machine shown having a range of from 4 to 13 inches. The variable-speed drive to the feed mechanism permits the machine to be slowed down for cutting off unusually long pieces of stock.

The automatic stop, which regulates the length of the material cut off, slips out of the way an instant before the stock is fed forward for the next cut and then drops back into place. This stop enables pieces to be accurately cut to the required length within limits of plus or minus 0.005 inch.

There are three control stations, one on each side of the machine and a third at the front of the material support. Each station controls both motors, so that a stationary saw cannot be fed into the material. This machine can be seen in operation in Booth L-53 at the National Metal Exposition, to be held in Cleveland.

## Foote-Burt Four-Way Drilling and Tapping Machine

The four-way, twenty-five-spindle combination drilling and tapping machine here illustrated has been built by the Foote-Burt Co., Cleveland, Ohio, for use in drilling, chamfering, and tapping an automotive part. This machine has four heads. The upper, left-hand, and rear heads are mounted on hydraulic feed drilling units, the upper unit being one of the largest sizes made, having ways 16 inches wide. The left-hand and rear units have ways 10 inches wide. The right-hand head is mounted on a unit provided with a lead-screw for tapping operations, and has ways 10 inches wide. All units are electrically controlled and are started by means of a push-button.

Each unit of the machine goes through its individual cycle and returns to the starting point, where it remains until the push-button is again operated. The fixtures which hold the work are mounted on a four-position, circular, indexing table, three parts being loaded at each station. The upper head performs three operations on each part — drilling at the second station, boring at the third station, and line-reaming at the fourth station. The four heads of the machine perform six separate operations on each part at every complete cycle of the machine.

## Producto Hand Milling Machine

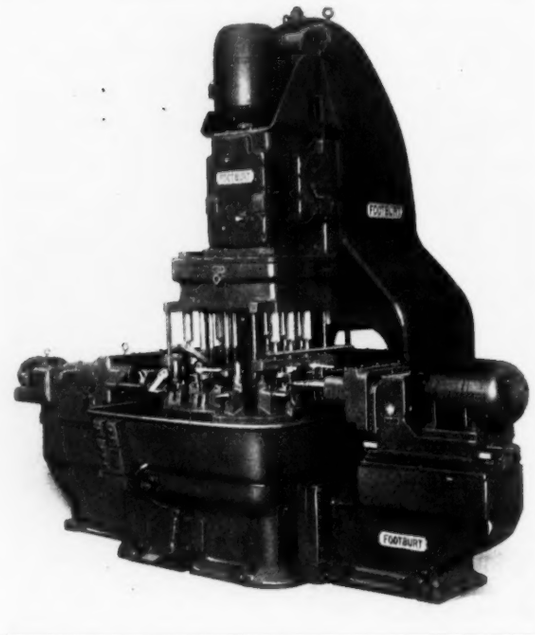
A hand milling machine of heavy-duty design has been brought out by the Producto Machine Co., Bridgeport, Conn., for precision work. All slides on this machine are fitted with tapered gibs and all bearing surfaces are accurately fitted and scraped. The cutter-spindle revolves in Timken roller bearings, and all shafts in the transmission are mounted in ball bearings.

The one-piece column supports the slides for the knee and cutter-head, and also provides a convenient method of mounting the motor on top of the machine. It fully encloses a new style of transmission which gives quick changes of spindle speeds. This transmission consists of V-belts and pulleys which provide six speed changes. There is a quick method of shifting the belt and of locking its position after an adjustment has been made.

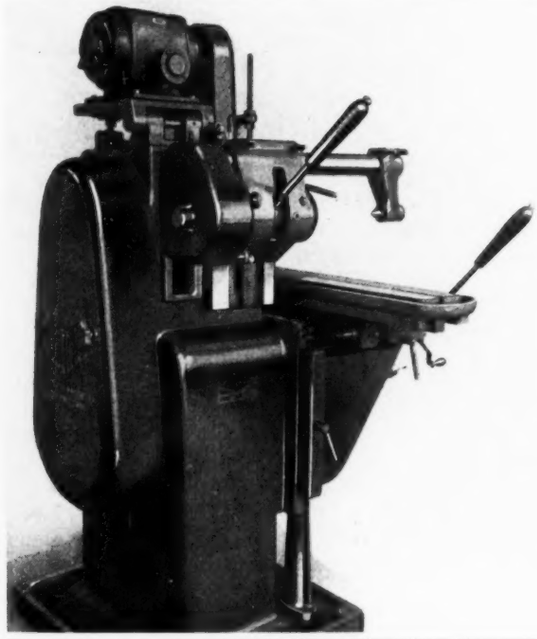
The ordinary range of spindle speeds provided is from 106 to 1050 revolutions per minute, but lower and higher speed ranges can be supplied if desired. The base of this machine measures 30 by 28 inches, and the working surface of the table, 26 by 6 inches. There is a table feed of 8 inches by means of a hand-lever, and of 20 inches by means of a crank-lever. The cross-feed is 7 inches, and the vertical feed 15 inches.

## General Electric Three-Shoe Magnet Brake

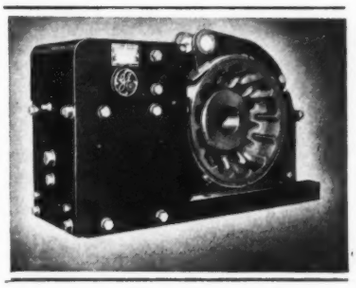
A three-shoe spring-set direct-current magnet brake, which combines the mounting flexibility of the two-shoe brake with




Foote-Burt Four-way Drilling and Tapping Machine



Producto Hand Milling Machine of Heavy-duty Design



Three-shoe Magnet Brake for Cranes, Hoists, and Other Equipment

the braking surface protection of the band type brake, has been developed by the General Electric Co., Schenectady, N. Y. This new brake is intended for use on cranes, hoists, conveyors, steel mill machinery, and other applications in which it is necessary to stop and hold the load at the motor armature. The frame is of bar-and-plate welded construction.

The peripheral length of the brake lining is about 85 per cent that of the wheel periphery. Thus it affords a protection against dust and dirt that greatly reduces wear on the wheel and lining. The brake-shoes are self-aligning, and the braking effect is equal in both directions of rotation. The desired braking effect is obtained by adjusting the position of the shoes and the amount of spring compression. The actuating mechanism incorporates a clapper type magnet, so constructed as to insure positive operation even under severe service conditions.

## Olsen Electric Elongation and Compression Recorder

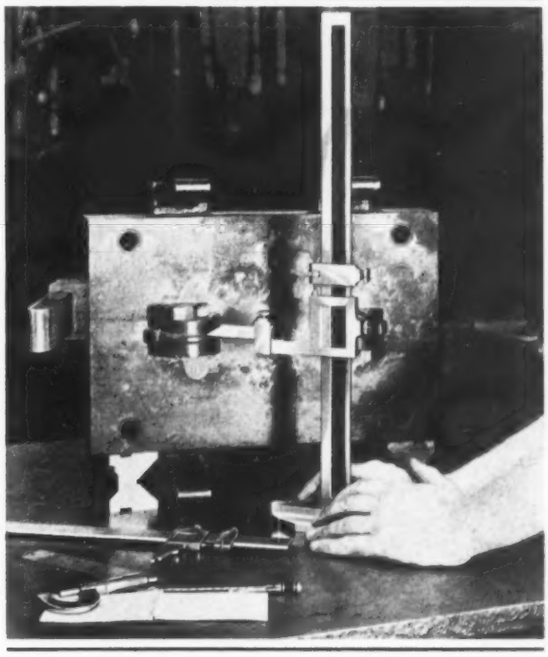
One of the machines to be exhibited at the Cleveland Exposition (Booth B-8) by the Tinius Olsen Testing Machine Co., 500 N. 12th St., Philadelphia, Pa., will be equipped with a high-magnification electric elongation and compression recorder. This apparatus will be fitted with an extensometer designed especially for use on thin sheet metal down to 0.001 inch thick and also on light round specimens.

This recorder operates on a principle that differs completely from previous methods of recording elongation and compression. It is arranged for a standard specimen 2 inches in gage length, and has three ranges of magnification, 2000, 1000, and 500 times. The instrument can also be supplied for any other three ranges in the ratio of 1, 1/2, and 1/4. It is stated that changes from one range to another can be accomplished in less than sixty seconds.

## Starrett Vernier Height Gage for the Inspection of Jigs

A vernier height gage designed for measuring and inspecting work on which unusually high standards of accuracy must be maintained has been produced by the L. S. Starrett Co., Athol, Mass. This gage, known as No. 454, is shown in the illustration being used in the final inspection of a jig for an automotive production operation. This particular height gage has a range of from 0 to 18 inches, but gages 24 and 36 inches in length can also be furnished. Readings can be made by means

Tinius Olsen Testing Machine Equipped with New High-magnification Electric Recorder



Vernier Height Gage for Inspecting Jigs and Similar Work, Made by the L. S. Starrett Co.

of the vernier to 0.001 inch throughout the full length of the gage.

The hardened base is recessed in the bottom and ground and lapped square with the bar, so as to permit the gage to stand upright. The bar is about 1 1/4 inches wide by 1/4 inch thick, while the base is 5 1/4 inches long, 2 1/4 inches wide, and 13/16 inch high.

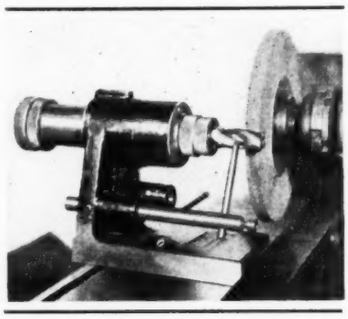
## Bullard Automatic Station Type Descaling Machine

The Bullard-Dunn electrochemical process for degreasing and descaling metals comprises an electrical treatment for the removal of grease and dirt from work and a second electrical treatment for removing scale without the slightest pitting, etching, or other damage to the work. To carry out this process automatically at a uniform rate of production and to eliminate the labor of immersing the work in the various treatment tanks and removing it, the Bullard Co., Bridgeport, Conn., has recently developed a machine which is shown diagrammatically in the accompanying illustration.

This machine, as indicated, consists of a central column to which radial arms are attached. Racks, hooks, or steel wire baskets for holding the work are suspended from these arms. The work is loaded at one station and automatically carried to the various tanks, which are positioned concentrically around the column. Prior to each indexing, the column is raised to lift the work from the tank in which it has been submerged; and after the indexing, the column is lowered to immerse the work in the next tank. This sequence continues until all of the arms have been loaded, after which the work that was first placed on the machine arrives at the loading station, where it is replaced by a fresh load of work.

The machine is controlled automatically by an adjustable electric time switch, and can also be made to function at the will of the operator through a push-button control.

The concern will present at the National Metal Show (Booth M-54) a moving picture demonstration of a continuous rotary immersion machine and will demonstrate the Bullard-Dunn process.



Using the "Little Wonder" Fixture in Grinding a Spiral End-mill

## "Little Wonder" Cutter-Grinding Fixture

The grinding of a spiral end-mill along its cutting edges is shown in the accompanying illustration being performed with the cutter held in a fixture produced by the Luther Mfg. Co., 58 Knecht Drive, Dayton, Ohio. In this operation, the spindle of the fixture is moved forward and backward, and at the same time rotated or swiveled so as to hold one of the cutting edges firmly against a guide finger, previously adjusted to the proper position.

This fixture also facilitates grinding the ends of such cutters, as well as the front and side cutting edges of angular cutters and straddle-mills.

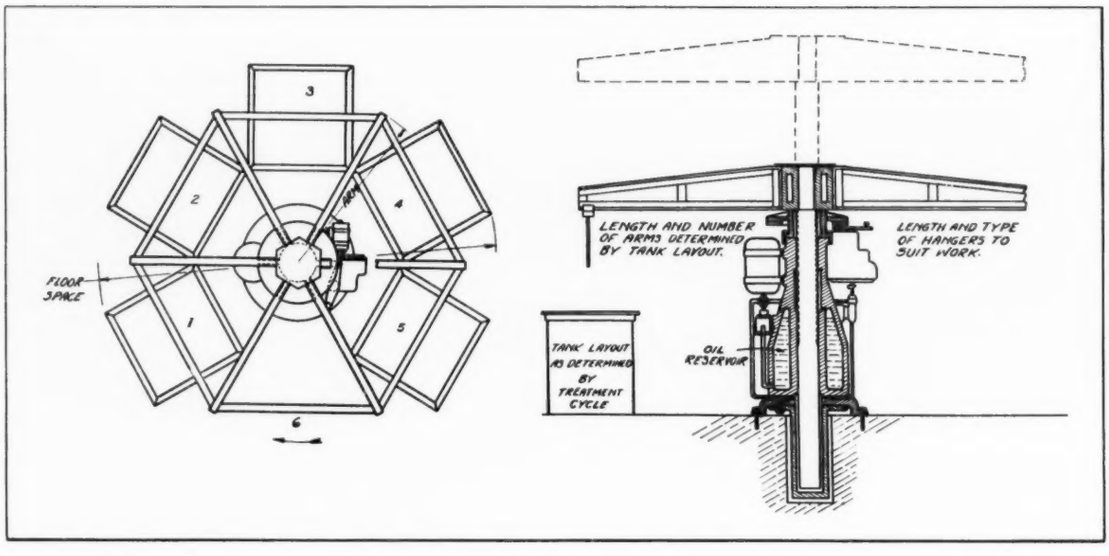



Diagram of Machine Developed by the Bullard Co. for Automatically Degreasing and Descaling Metal Products

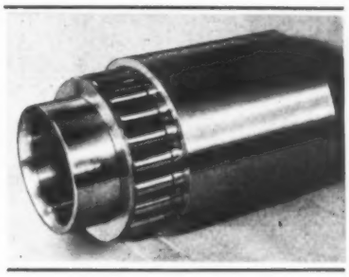
## Williams-White Hydraulic Tube-Bending Machines

Three high-production hydraulic tube-bending machines recently developed by Williams, White & Co., Moline, Ill., have been built for the Servel Corporation, Evansville, Ind. These machines, two of which are shown in the accompanying illustrations, are for use in the manufacture of Electrolux refrigerators.

Sixteen tubes are bent up to and including an angle of 180 degrees simultaneously on the machine shown in Fig. 1, eight tubes being inserted in the front dies and the other eight in the rear dies. Adjustable stops are provided which can be set for bending the tubing to any desired angle. After the tubes are bent, the die clutches are released by compressed air and the bending units returned to the starting positions. An air-operated ejector is provided, which raises the bent tubes 4 to 6 inches. After the tubes have been removed from the machine, the bending dies are returned to the starting positions by an air-impelled rack.

An operator is stationed at the front of the machine and a helper at the rear of the machine. The two throttle valves are interlocked, so that both the helper and the operator must work together. This protects both men against accidents. Specially designed arbors are used inside the tubes to prevent flattening or wrinkling. Adjustable gages are provided to accommodate tubes of different lengths. With accurate tubes, it is possible to fill, bend, and unload the machine in approximately thirty seconds, giving a production rate of approximately 1920 bends per hour.

The hydraulic machine shown in Fig. 2 is used to complete the bending operations on continuous flat coils produced on a horizontal machine (not shown) which bends the tubing to the shape shown in the lower right-hand corner. The machine shown in this illustration performs the bending operation that completes the work, as shown at the base of the machine in the lower left-hand corner of the illustration. This completed coil is produced by bending the continuous flat coil through an angle of 180 degrees to the U-shape shown.



Fafnir Heavy-duty Industrial Roller Bearing

## Extended Range of Fafnir Roller Bearings

Heavy-duty industrial roller bearings are now being manufactured by the Fafnir Bearing Co., New Britain, Conn., in an extended range that includes almost one hundred sizes. The rated capacity of these bearings ranges from 10,000 to 500,000 pounds. The series is suitable for the severe service requirements of paper mills, steel mills, heavy metal-working machinery, rubber and oil field equipment, and the like.

Rollers of 3/4, 1 1/4, and 1 1/2 inches diameter are now used in these bearings, in addition to the 1 1/16-inch rollers of the bearings that were previous-

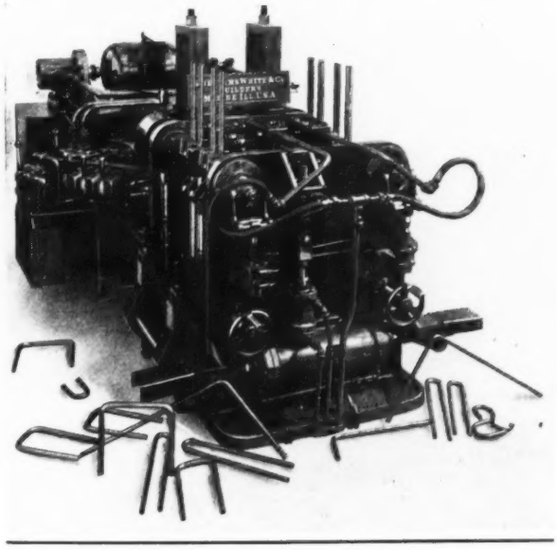


Fig. 1. Hydraulic Tube-bending Machine Built by Williams, White & Co.

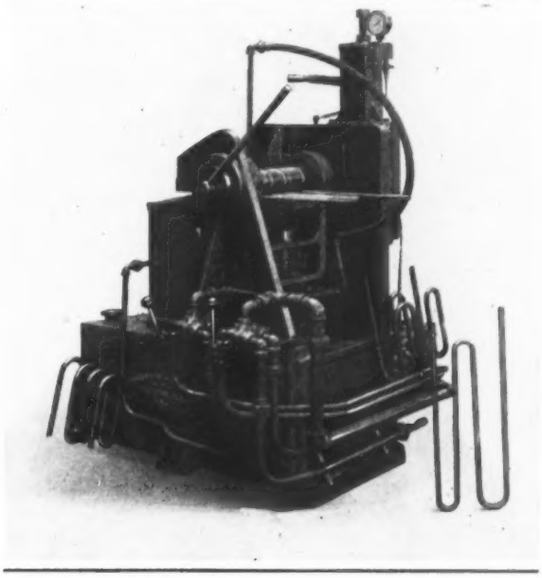


Fig. 2. Hydraulic Tube-bending Machine for Final Bending of Flat Coils

ly available. Eighteen different bores are furnished.

A feature of these roller bearings is the large number of solid rolls incorporated in the cage assembly, thus making for increased load capacity. The cage is fabricated from form-rolled spacer bar stock and hardened end rings. The rollers are held in place and guided by spacer bars rather than by rivets extending through the rolls themselves. The spacer bars are riveted to the end rings and the accurate assembly of these bars keeps the rolls permanently aligned. All parts of these bearings are ground to unusually close tolerances.

is effected by lowering or raising the lower horn on its slide.

When equipped with a motor drive, this welder can make from 30 to 100 welds a minute. The machine is also available in foot- and air-operated models, and is built in various sizes up to 250 kilovolt amperes.

## Bruning Improved Drafting Machines

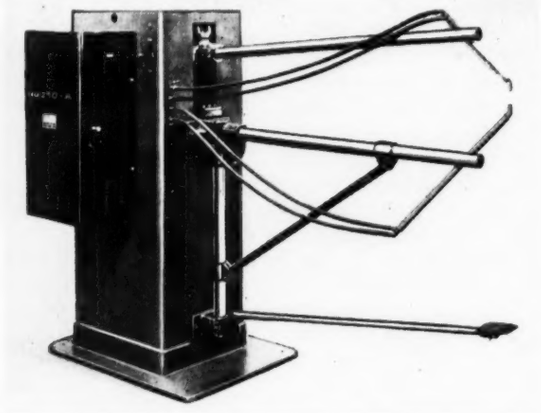
One of the features of a new line of drafting machines being introduced on the market by the Charles Bruning Co., Inc., 100 Reade St., New York City, is an adjustable brake mechanism that prevents the protractor head from sliding excessively when used on an inclined board. Adjustable skid buttons for leveling the scales and an elbow leveling device are other improvements. The pulleys are fully enclosed and the bands can be changed, if necessary, without disassembling the machine. Each machine is equipped with fully enclosed ball bearings.

These drafting machines are made in three models, the Standard Protractor Model, which is designed for the use of mechanical, architectural, and structural draftsmen; the Civil Engineer's Model, which is designed for map draftsmen and inventors; and the Deluxe Civil Engineer's Model, which is fitted with a micrometer adjustment screw tangent to the protractor that aids in accurately obtaining the required angles.

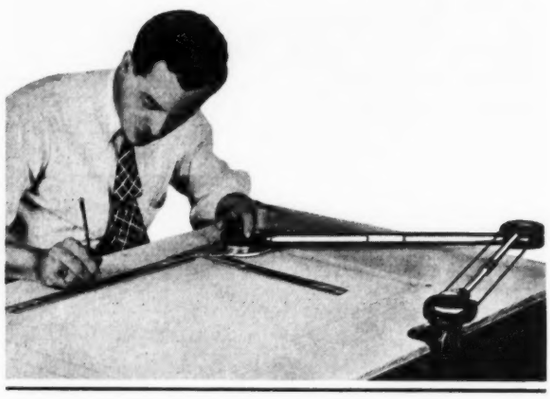
## Ahlberg Simplex Ball-Bearing Units for Machine Applications

Ball-bearing units designed to facilitate the application of ball bearings to machinery by reducing the machining operations often necessary heretofore to accommodate such bearings are being introduced on the market by the Ahlberg Bearing Co., 317-329 E. 29th St., Chicago, Ill. These units are especially intended for use when the bearing housing is to be either part of the machine itself or must conform to a manufacturer's specifications.

These units are available in three capacities for a given shaft size, and in two styles. All of them are equipped with self-aligning ball bearings which enable the units to compensate automatically for normal inaccuracies in assembly and for shaft deflections. A unit with an open-end cap is shown at the left in the illustration, while a unit with a closed-end cap is illustrated in the middle. The unit at the right is provided with an open-end cap and an oil flinger.



Eisler Welder with Horns 48 Inches Long

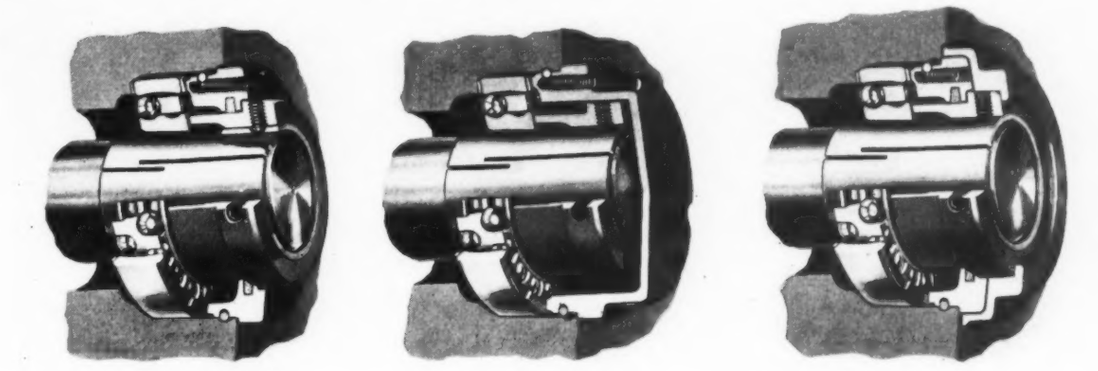


Drafting Machine with Brake for Protractor Head

## Eisler Welder for Long Work

Welding horns 48 inches long are provided on a special welder recently built by the Eisler Engineering Co., 750 S. 13th St., Newark, N. J., for use in manufacturing Neon light signs. The machine is also adaptable to welding metal boxes, office furniture, metal doors, and similar work.

In the manufacture of Neon light signs, the welder is especially suitable for the fabrication of frames, letters, etc. The water-cooled electrode-holders are positioned at an angle, so as to permit welding in corners or along edges. Adjustment of the distance between the electrodes



Ball-bearing Units Designed by the Ahlberg Bearing Co. for Simplified Installation

The end caps of units in the 21,000 series are provided with a generous felt seal, whereas the 23,000 and 25,000 series here illustrated have an additional labyrinth arrangement, which, in combination with the felt, provides an effective seal.

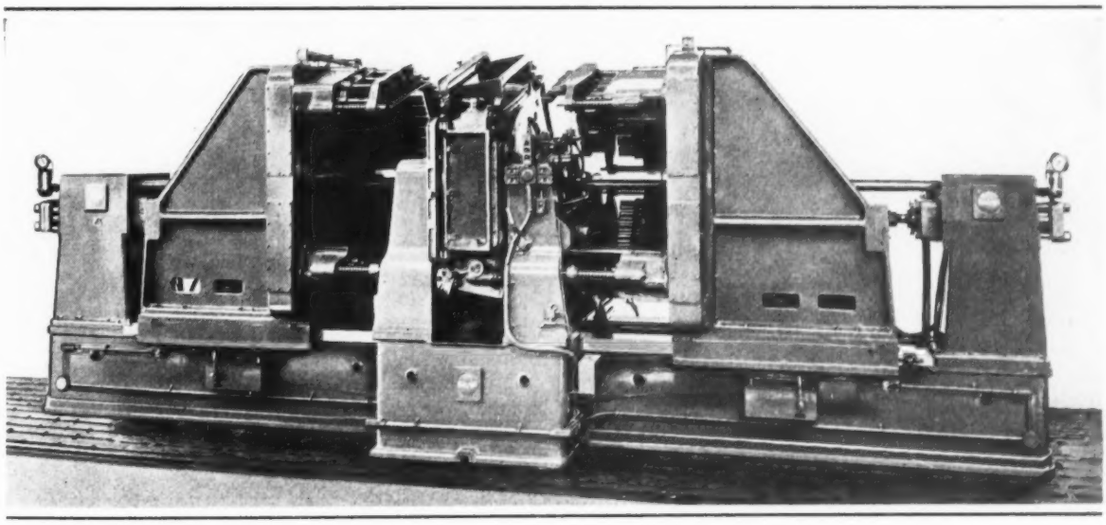
Units of the 21,000 series are locked to the shaft by means of two set-screws in the inner ring of the bearing, whereas units of the 23,000 and 25,000 series are supplied with a split adapter sleeve that is drawn into the tapered bore of the bearing by means of four set-screws. The sleeve is thus wrapped around the shaft over its entire length and locked firmly in position.

## Baush Drum Type Multiple-Spindle Machines

A horizontal multiple-spindle drilling machine weighing 73,000 pounds was recently built by the Baush Machine Tool Co., Springfield, Mass., for finishing, from the rough, all valve and tappet holes in an automobile cylinder block. It also core-drills a number of holes. The two heads of this machine are hydraulically actuated on a saddle plate. The right-hand head carries forty-eight spindles, and the left-hand head forty spindles. The left-hand head is driven by a 25-horsepower motor, and the right-hand head by a 30-horsepower motor. The five-station trunnion fixture is indexed hydraulically.

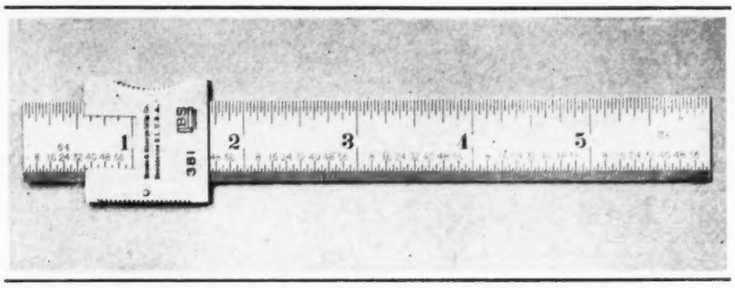
Including the spindle bearings, this machine contains 310 ball bearings and 230 roller bearings, which are said to reduce the power requirement from 20 to 25 per cent. The anti-friction bearings are so efficient that the entire set of spindles in either head can be turned over by hand. This machine has a production of from fifty-five to sixty cylinder blocks an hour.

A similar machine was recent-



Baush Hydraulically Operated Drum Type Machine for Multiple Drilling of Automobile Cylinder Blocks

ly built by the same company for automatically drilling, countersinking, reaming, counterboring, and tapping all the holes in the oil-pump and distributor pads of a six-cylinder engine block. This machine also spot-faces the oil-pump pad. It weighs 70,000 pounds.

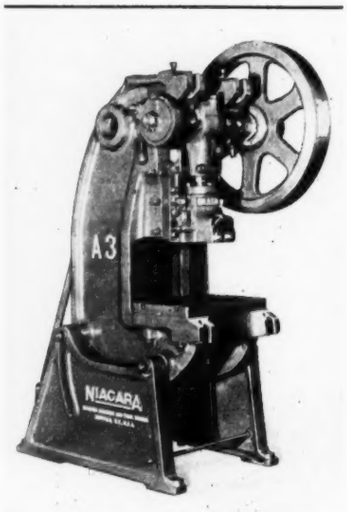



Steel Rule with Brown & Sharpe Slide that Facilitates Certain Measurements

## Niagara Master Series Press with Three-Inch Shaft

A No. A-3 inclinable press has been added to the Master Series A line of presses built by the Niagara Machine & Tool Works, 637-697 Northland Ave., Buffalo, N. Y. This press has a shaft 3 inches in diameter, and follows the improved design of other machines in the same series having shafts ranging from 1 1/4 to 5 1/2 inches in diameter.

Among the features of the new machine are adjustable and removable double-vee gibs; a new type of slide with a breech-block die clamp; a fourteen-point engagement sleeve clutch with a built-in single-stroke mechanism; crankshaft bearings that are split at a 45-degree angle, so as to transmit the entire thrust direct to the frame; a self-contained back-shaft assembly that is mounted in Timken bearings (on the geared models); and a one-man inclining mechanism equipped with anti-friction bearings.




Latest Addition to the Niagara Master Series A Presses

## Brown & Sharpe Rule Slide and Stainless-Steel Micrometers

A slide that can be applied to several steel rules to facilitate many measurements has been announced by the Brown & Sharpe Mfg. Co., Providence, R. I. This rule slide, No. 381, can be applied to 6-inch rules Nos. 300, 301, 302, 315, and 350 in the manner illustrated. It also makes a caliper rule out of the No. 320 hook rule.

The slide can be easily slipped on a rule and removed, and may be used with either side pointed upward. It is especially convenient in measuring the height of a shoulder from a flange and in determining similar dimensions. A spring keeps the slide in any setting.

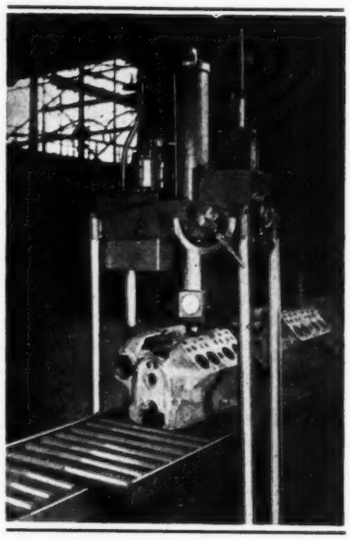
This company has also recently announced two new stainless-steel micrometer calipers identified as Nos. 12B and 13B. The stainless-steel frame and thimble of these micrometers are proof against the rust and stain ordinarily caused by handling or by liquids and solutions. The anvil and spindle are made of the same wear-resisting materials as other B & S micrometer calipers.

These micrometers are made with the new C-type frame having a narrow anvil that facilitates measuring deep slots. They are available in both English and metric measure. In general appearance, they are similar to the Nos. 12 and 13 models illustrated in July MACHINERY, page 758.

## Brinell Testing Machine for Conveyor Applications

A Brinell hardness testing machine for checking cylinder blocks, cylinder heads, and other parts as they move along a conveyor was recently produced by the Detroit Testing Machine Co., 5137 Trumbull Ave., Detroit, Mich. From the illustration, it will be seen that the ram of this equipment eliminates the necessity of raising the work for the operation. The ram has a travel of 24 inches.

Oil is used as the pressure medium for operating the ram.



Hardness Testing Equipment Installed along a Conveyor

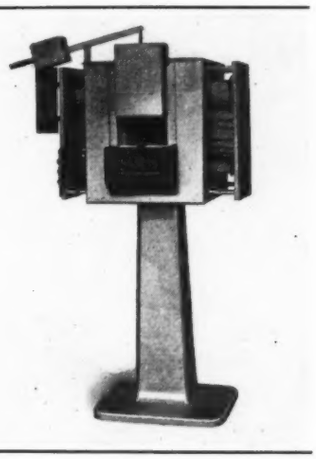
It is kept at a constant temperature by means of a thermostatically controlled heating element and, therefore, is not subject to viscosity changes due to varying temperatures. The conveyor section of the machine is designed to provide a solid support for the work when the hardness-testing load is applied. Tests can be made without grinding or spotting the work and without using a microscope.

This equipment is fitted with a direct-reading device made by the concern. After tolerance hands have been set to indicate the desired limits, it is merely necessary for the operator to note the position of the pointer as each test is made.

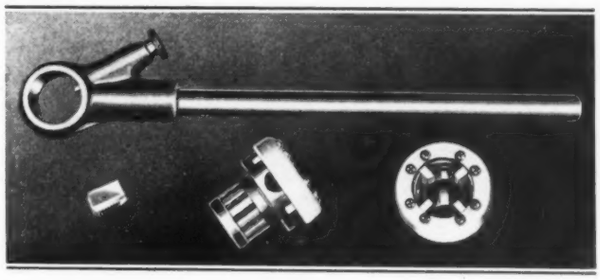
## Sentry Electric Furnace for Hardening High-Speed Steel

The Sentry Co., Foxboro, Mass., has brought out a small furnace primarily designed for hardening high-speed steel, which is larger than the model described in September, 1935, MACHINERY, page 88. The new No. 2 Model Y furnace is also a muffle furnace with four heating elements, two above and two below the muffle. It employs air-cooled terminals, which eliminates cooling-water connections. The terminals and all electrical contacts are shielded, and the heating elements are claimed to give considerably more than 1000 hours of service.

This furnace is designed on the Diamond Block method of atmospheric control. The muffle chamber is 4 1/2 inches wide by 4 inches high by 11 inches deep, and will accommodate the five standard Diamond Block sizes. The furnace will heat from cold to 2350 degrees F. within seventy minutes. The current consumption at the high temperature is between 4 1/2 and 9 kilowatts, depending upon the amount of work being hardened. This furnace can be supplied with a pedestal, as shown, or without a pedestal.



Larger-sized Sentry Furnace for Hardening High-speed Steel



Beaver Ratchet Pipe-threading Tool

## Beaver Ratchet Pipe-Threading Tool

The No. 2 ratchet pipe-threading tool here illustrated has been added to the line of threading equipment made by Beaver Pipe Tools, Inc., Warren, Ohio. It is made of unbreakable air-furnace malleable iron and has a rust-proof finish. Oil-holes are provided in the die-heads to facilitate oiling and to furnish chip clearance. The vanadium alloy steel dies are square in shape and have no offsets. They can be inverted for threading close to walls or easily removed for resharpening.

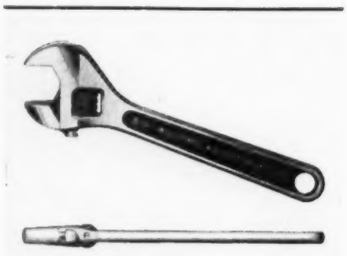
This tool is available for right- or left-hand threads of the American Briggs or British Whitworth standard. Straight thread American conduit dies in 1/2 and 3/4 inch sizes; dies for Boston brass tubing 3/4 inch outside diameter with twenty threads per inch; and adjustable bolt dies and die-heads in sizes from 1/4 to 1 inch varying by sixteenths of an inch with USS or SAE threads are also available.

## "Holdsall" Small-Parts Cabinet

A metal cabinet designed especially for the systematic storing of small parts has been placed on the market by the General Fireproofing Co., Youngstown, Ohio. This cabinet is about 30 inches high, 20 inches wide, and 15 inches deep. It has ten drawers of various heights.

Three of the drawers have fixed compartments, while the other seven are so made that compartments of different dimensions can be obtained by merely shifting the partitions. Parts up to 14 1/4 by 9 1/4 by 3 1/4 inches can be stored. The cabinet can be set on a bench or attached to steel brackets mounted on a wall. It is finished in olive-green crinkle enamel.

Steel Cabinet Designed for Storing Small Parts



Williams Adjustable Wrench with Jaw Shank of Improved Design

## Williams Adjustable Wrenches of New Design

Several new features of design are embodied in two lines of adjustable wrenches that are being introduced on the market by J. H. Williams & Co., 75 Spring St., New York City, under the trade names "Adjustable" and "Superjustable." These wrenches are provided with square shoulders on the movable jaw shank which are said to overcome any wedging or spreading action. They also provide a positive bearing for withstanding working stresses. A thicker and stronger web has been obtained without increasing the total head thickness.

The "Adjustable" wrenches are drop-forged from a carbon steel that provides unusual strength. The wrenches of this line are supplied with a natural polished-steel finish. The "Superjustable wrenches are forged from a chromium-alloy steel that provides a strong, well balanced tool of thin and light design. This line of wrenches is chromium-plated, the heads being highly polished and the handles satin-finished. Both lines are available in 4-, 6-, 8-, 10- and 12-inch sizes.

## Lyon High-Elevation Lift Truck

A hydraulic lift truck having 10 inches of elevation is being placed on the market by the Lyon Iron Works, Greene, N. Y. This truck was developed from another hydraulic lift truck having an elevation of 6 inches. The additional 4 inches of elevation are obtained by means of an auxiliary frame which is elevated through a lever arrangement.

The head which contains the hydraulic mechanism is the same as that supplied on the standard hydraulic lift truck made by the company, which has an elevation of 3 inches. In other respects also, the construction of the high-elevation truck follows the design of the standard truck. For example, the frame is electric arc welded, and Hyatt bearings are supplied for the rear wheels, Timken bearings for the front wheels, and ball thrust bearings for the steering mechanism.

Lyon Truck with an Elevation of 10 Inches

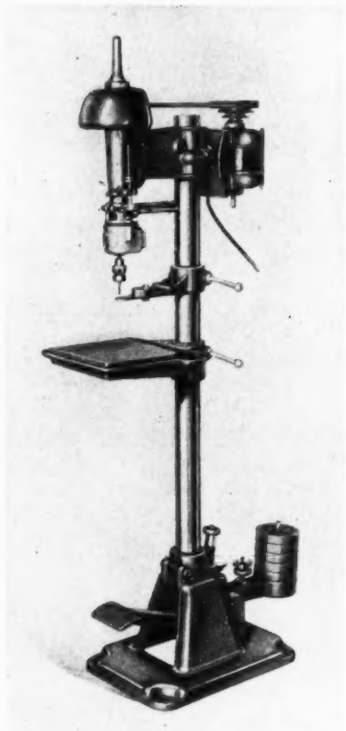
## Ettco-Emrick Vertical Tapping Machine

A high-speed, sensitive tapping machine known as the Ettco-Emrick has been brought out by the Ettco Tool Co., 594 Johnson Ave., Brooklyn, N. Y., for use in place of a drilling machine when performing the usual tapping operations with a single- or multiple-spindle tapping head. This machine is operated by a foot-treadle, leaving both of the operator's hands free to handle the work, which can be easily located and held in position.

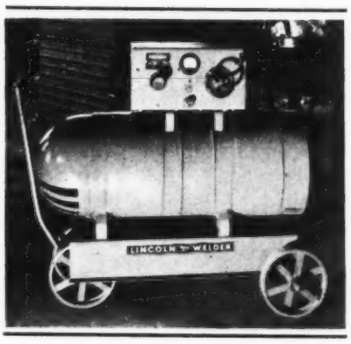
In operation, the foot-treadle is simply pushed down to a stop, after which the tapping is done automatically. The foot-treadle is balanced to suit the operator, so that practically no effort is required to start the tapping operation. A built-in stripper enables most work to be done without a fixture, although a simple work-holder may be used in some cases. The machine has a capacity for tapping holes up to 5/16 inch in soft metal, and up to 1/4 inch in this steel. Tapping speeds up to 2100 revolutions per minute can be employed with a reverse speed of 3600 revolutions per minute.

## Lincoln Welders with Continuous Dual Arc Control

A new line of single-operator arc welders known as the Shield Arc S A E has been brought out by the Lincoln Electric Co., Cleveland, Ohio, to supersede the Shield Arc welders that have



Ettco-Emrick High-speed Tapping Machine



Lincoln Arc Welder with New Method of Arc Adjustment

been on the market for the last six years. The distinctive feature of the new arc welders is a method of arc control that makes possible the adjustment of both the arc heat and arc penetration in a continuous sequence of fine increments. It is claimed that this continuous dual control insures uniformity of performance at every control setting and greatly facilitates successful arc welding. This machine will be demonstrated at Booth F-23 at the National Metal Show, to be held in Cleveland.

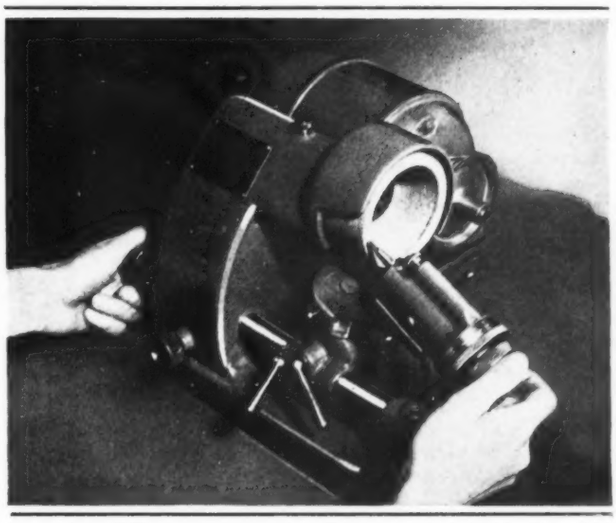
For certain types of arc welding, a low voltage with a wide range of current control is available, while for other work, a higher voltage with the same wide current range is available. All other design features of the Shield Arc models, such as independent excitation, laminated magnetic circuit, all-purpose meter, polarity reversing switch, and no-voltage motor protection are retained in the new type. The base and portable parts have been redesigned to obtain more of a streamline effect and a shorter wheel-base.

Shield Arc SAE welders are available with alternating- or direct-current motor drives, with a generator for belt or couple service, and with an engine drive. They are made in ratings of 200, 300, 400, and 600 amperes.

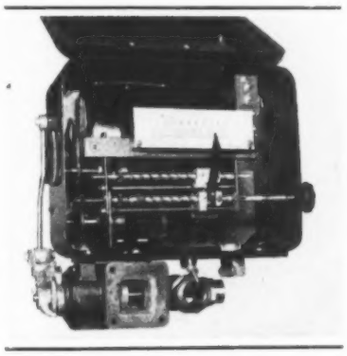
## Deckel Universal Cutter-Grinding Machine

The universal action of the cutter-holding unit on the Deckel cutter-grinding machine here shown permits the complete grinding of various shapes of single-lip cutters for fine milling, profiling, and engraving operations. Round-nose, flat-face, and pointed cutters, with either straight or angular side cutting edges, can be ground both for profile and relief to meet specifications for shape and size. This machine, which is being introduced on the American market by the H. P. Preis Engraving Machine Co., 156-157 Summit St., Newark, N. J., is available in bench and floor types.

The axis about which the grinding arm of this machine is swung in operation, is adjustable to any required angular position by means of two swivel bearings. Graduations insure accuracy of the angular settings, and micrometer screws enable fine feed movements of the cutter toward the wheel. This machine makes it unnecessary to carry a large variety of cutters in stock.



Sharpening a Single-lip Profile Cutter on the Deckel Universal Cutter Grinder

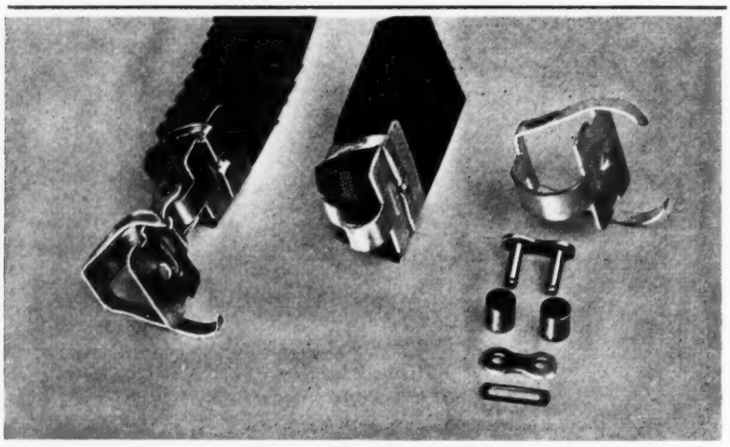


Mechanism of the Lindberg Throttling Control Unit

## Lindberg Throttling Temperature Control Unit

The Lindberg Engineering Co., 224 Union Park Court, Chicago, Ill., has developed temperature control equipment which provides an extremely sensitive control. This is a fully automatic unit that eliminates all possibility of drifting above or below the desired temperature. It requires no manual adjustment, and is practical for use on batch furnaces and other applications where a wide range of heat input is desired.

The unit consists of a standard proportioning valve driven by a reversible motor. The low-limit switch is fixed, while the upper-limit switch is automatically adjusted by means of the motor, the latter being operated by contacts. When the temperature is in neutral, the valve remains fixed at the point set by the adjusting limit switch. The slightest tendency of the furnace to vary in temperature above or below neutral causes an immediate adjustment of the valve opening. This throttling control will be displayed in Booth L-33 at the National Metal Exposition.



Details of the Grip-Flex Roller-bearing Coupling for Connecting the Ends of V-belts

## Roller-Bearing Couplings for V-Belts

Couplings of a roller bearing design for joining the ends of V-belts are being introduced by the Shippert Mfg. Co., 414 S. Galena Ave., Dixon, Ill. These Grip-Flex couplings are made in various sizes and types. As will be seen from the illustration, each coupling consists of anchor plates which completely surround the ends of the belt; trailer pins that ease the strain of heavy loads or shocks; side plates; and replaceable rollers.

Unusual strength, dependable service, easy installation, freedom from vibration, and quiet operation are advantages claimed for these couplings.

## Grinding Wheel for Finishing Tools and Stainless-Steel Parts

One of the exhibits of the Manhattan Rubber Mfg. Division of Raybestos-Manhattan, Inc., Passaic, N. J., at the Cleveland Metal Exposition (Booth H-2) will be a recently developed grinding wheel designed particularly for finishing operations on parts made from stainless steel and for taps, twist drills, and work of similar nature. This wheel is relatively firm, but is not rigid like the usual grinding wheel. On the other hand, it is not soft enough to conform to irregular shapes like ordinary cloth polishing wheels.

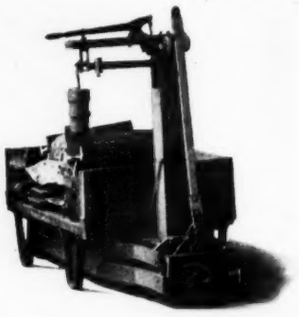


Fig. 1. Yale & Towne Lift Truck with Weighing Scale

## Yale & Towne Lift Trucks with Special Features

When raw materials and finished work must be weighed, it is necessary in many plants to truck the materials or work a considerable distance to a floor scale. To avoid the necessity of doing this, the Yale & Towne Mfg. Co., Philadelphia, Pa., has recently developed a hand lift truck that is equipped with a scale. After this truck is pushed under a load and the handle pulled down, a single stroke of the handle suffices to raise the load from the floor and also to weigh it. The model illustrated in Fig. 1 is equipped with a 2500-pound beam scale.

Another hand lift truck made by the concern especially for handling work that is easily damaged is illustrated in Fig. 2. All six wheels of this truck are equipped with pneumatic tires. Loads up to 1500 pounds can be carried.

## Stanley Electric Soldering Irons

A new line of electric soldering irons has been placed on the market by the Stanley Rule & Level Plant, New Britain, Conn. These soldering irons are operated on either alternating or direct current. By means of a lock-collar and sleeve, the ventilated handle can be adjusted to any desired length.

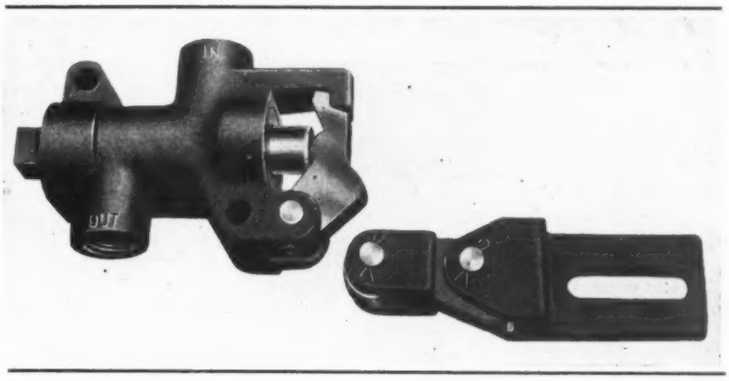
The soldering irons have compressed pure copper tips machined for a valve-fit connection with the heating heads, thus assuring effective heat conduction and protection to the metal connecting surfaces from oxidation and flux corrosion. Hermetically sealed heads protect the built-in windings and solid copper cores from air, flux fumes, and moisture. The irons are made in eight different sizes, ranging from 52 watts with a 7/16-inch tip to 435 watts with a 1 9/16-inch tip.

Fig. 2. Lift Truck with Pneumatic Tires for Absorbing Shocks

## "Quick-As-Wink" Work-Ejector Valve

A valve designed for ejecting work from punch presses and other equipment through the intermittent delivery of compressed air is a new product of C. B. Hunt & Son, Salem, Ohio. As the illustration shows, this valve is actuated by a roller which bears against a cam-lever. The compressed air is expelled only during the moment of actuation, the valve then being closed automatically by a spring. A stop bracket limits the return of the cam-lever.

With the exception of the return spring and the cam-lever, the body is the only moving part in the valve proper. The operating principle of this valve is the same as that employed in other "Quick-As-Wink" control valves. There is no metal-to-metal wear in the valve action. The packings are of such a construction that the air seal becomes tighter in proportion to the increase in air pressure.



Air Valve Made by C. B. Hunt & Son for Ejecting Work from Presses

# NEW BOOKS AND PUBLICATIONS

ENGINEERING ALLOYS. By Norman E. Woldman and Albert J. Dornblatt. 622 pages, 6 by 9 1/4 inches. Published by the American Society for Metals, 7016 Euclid Ave., Cleveland, Ohio. Price, $10.

This book has been prepared to meet the growing demand for a practical and technical reference book on engineering alloys. The authors have made a careful compilation of the available data and information on practically all proprietary commercial and technical alloys manufactured in the United States and on many alloys made in foreign countries; 8200 different alloys are included. The book contains data covering the chemical composition, physical and mechanical properties, uses, and manufacturers of these alloys.

The material is divided into seven sections: Section 1 contains an alphabetical listing of all alloys; Section 2 gives the trade name, composition, properties and uses; Section 3 contains an index of the alloys classified according to typical uses or special characteristics; Section 4 contains an alphabetical listing of the manufacturers, with a summary of the alloys produced by each; Section 5 lists the manufacturers with their addresses according to the serial number used to distinguish the alloys; Section 6 gives sources of information; and Section 7 comprises an appendix containing useful tables and miscellaneous information pertaining to the properties, testing and heat-treating of alloys.

THE EFFECT OF OVERSTRAIN ON CLOSELY COILED HELICAL SPRINGS AND THE VARIATION OF THE NUMBER OF ACTIVE COILS WITH LOAD. By D. H. Pletta, assistant professor of applied mechanics, and S. C. Smith and N. W. Harrison, research fellows in applied mechanics, Virginia Polytechnic Institute. 30 pages, 6 by 9 inches. Published by the Virginia Polytechnic Institute, Blacksburg, Va., as Bulletin No. 24 of the Engineering Experiment Station.

FOUNDRY WORK. By R. E. Wendt. 240 pages, 5 by 7½ inches; 208 illustrations. Published by the McGraw-Hill Book Co., Inc., New York City. Price, $2.

This is the third edition of this book, which has been supplemented with information covering recent developments in the making of castings, including such subjects as mass-production foundries, standard pattern colors, alloy gray iron and alloy-steel castings, together with data on the correct design of castings. The book is divided into four parts, the first of which deals with the different groups of casting metals and fundamental principles of molding and core-making; the second with melting and mixing of metals; the third with bench and floor molding, dry-sand core-making, and problems in foundry management; and the fourth with non-ferrous metal founding. The book also contains a glossary of foundry terms, tables, and a list of other books on foundry work.

WHY QUIT OUR OWN? By George N. Peek and Samuel Crowther. 353 pages, 5 1/2 by 8 1/2 inches. Published by the D. Van Nostrand Co., Inc., 250 Fourth Ave., New York City. Price, 50 cents.

This book aims to give a complete picture of an adequate national program for the American farm and factory. The authors discuss the policies of the Administration with reference to agriculture and foreign trade, as evidenced by the working of the AAA and the Reciprocal Trade Agreements Act. In the last chapter, "What Can be Done," nine points are suggested for attaining the objective of affording opportunity for employment to all our people of working age in such fashion as to permit the free exchange of goods and services.

A STUDY OF TORQUE AND ITS INFLUENCING FACTORS AS RELATED TO COMMERCIAL TAPPING OF METALS. By Harry L. Daasch and John Hug. 52 pages, 6 by 9 inches. Published by the Iowa Engineering Experiment Station, Iowa State College, Ames, Iowa, as Bulletin 123.

# NEWS OF THE INDUSTRY

## California

EX-CELL-O AIRCRAFT & TOOL CORPORATION, 1200 Oakman Blvd., Detroit, Mich., announces the appointment of the HERBERTS MACHINERY CO., LTD., 2929 Santa Fe Ave., Los Angeles, Calif., as exclusive machinery sales representative in southern California, handling Ex-Cell-O Junior and Senior precision boring machines, precision thread grinders, multiple drilling equipment, cemented-carbide tool grinders, hydraulic power units, special machinery, and jigs and fixtures.

ADAM-HILL CO., 244 Ninth St., San Francisco, Calif., has recently taken over the distributorship in the San Francisco-Oakland territory, for the line of gears, sprockets, and speed reducers made by the Ohio Gear Co., Cleveland, Ohio.

FREDERICK S. COOK has been appointed Pacific Coast manager for the Robert W. Hunt Co., engineers, Chicago, Ill. Mr. Cook's headquarters will be at San Francisco, Calif.

## Illinois

OSCAR W. HEDSTROM PATTERN WORKS, 4836-42 W. Division St., Chicago, Ill., announces that the firm, beginning early in October, will start a new foundry division for the production of quality aluminum castings. This division is located in the west half of the company's new plant, purchased and occupied in September, 1935. The firm has had thirty years' experience in the manufacture of pattern equipment for castings and is thoroughly familiar with foundry practice of every description.

FEDERAL PRODUCTS CORPORATION, 1144 Eddy St., Providence, R. I., manufacturer of precision measuring instruments, has opened a new office in Chicago, located in the Chicago Daily News Bldg., 400 W. Madison St. W. E. CARROLL, who has been connected with the organization in Providence for several years, will have charge of the new office and will be assisted by A. M. GRANT.

J. E. BUCKINGHAM has been elected vice-president in charge of sales for the western district of the Lincoln Electric Railway Sales Co., Cleveland, Ohio. Mr. Buckingham's headquarters will be in the Straus Bldg., 310 S. Michigan Blvd., Chicago, Ill. He has been connected for the last fourteen years with the Worthington Pump & Machinery Corporation, Harrison, N. J., of which he was western regional manager of the railroad division.

ARTHUR WAGNER CO., 701 W. Washington St., Chicago, Ill., has been appointed distributor in the northern Illinois territory of the electric motors, generators, engine-driven generator sets, and portable lighting plants made by the HARNISCHFEGER CORPORATION, 4536 W. National Ave., Milwaukee, Wis.

DR. THOMAS C. POULTER has been appointed a director of the Research Foundation of the Armour Institute of Technology, Chicago, Ill. Dr. Poulter was chief of the scientific staff of the 1934 Byrd Antarctic Expedition.

LINK-BELT CO., 300 W. Pershing Road, Chicago, Ill., has acquired the manufacturing and sales rights for North America for the Dunford & Elliott rotary louvre dryer.

W. I. BROCKSON has been elected vice-president of the Commercial Advertising Agency, 440 S. Dearborn St., Chicago, Ill.

## Michigan

WILLIAM F. WISE has been appointed president of the Republic Products Corporation, 441 York St., Detroit, Mich., manufacturer of precision machine products. Mr. Wise has been general sales manager of the Ex-Cell-O Aircraft & Tool Corporation, of Detroit, for the last nine years. R. B. CRIDDLE has been appointed secretary-treasurer of the company. He was previously sales manager of the Machinery Division of the Ex-Cell-O organization.

JAMES R. BUCHANAN has joined the field metallurgical staff of the Detroit district sales office of the Union Drawn Steel Co., Massillon, Ohio. He has previously been connected with the home office of the company. Mr. Buchanan was formerly associated with the metallurgical department of the Chevrolet Motor Division of the General Motors Corporation in Flint, Mich.

STERLING-FRENCH MACHINERY CO., New Center Bldg., Detroit, Mich., has been appointed exclusive Detroit sales agent for the Reed-Prentice Corporation, Worcester, Mass., manufacturer of lathes, vertical milling and die-sinking machines, die-casting machines, plastic molding machines, band saw and filing machines, and special production equipment.

S. E. SJOGREN has been appointed district sales manager of the Columbia Tool Steel Co., with headquarters at 1718 Howard St., Detroit, Mich. This appointment was made to fill the vacancy recently caused by the death of Alexander Luttrell.

*S. E. Sjogren, Detroit District Sales Manager, Columbia Tool Steel Co.*

SIGNAL ELECTRIC MFG. CO., Menominee, Mich., is building a two-story addition to its plant, 79 feet long by 56 feet wide. The increased demand for fans, fractional-horsepower motors, drills, and other Signal products made this expansion necessary.

RALPH FISHER, formerly of the Houdaille-Hershey Corporation, has been appointed sales manager of the Stamping (Eaton Detroit Metal Co.) and Bumper Divisions of the Eaton Mfg. Co., with headquarters at 9771 French Road, Detroit, Mich.

## Missouri and Oklahoma

GEORGE S. DENITHORNE has been appointed sales representative in the Philadelphia area for the Medart Co., St. Louis, Mo., manufacturer of power transmission machinery. Mr. Denithorne's headquarters will be at 1224 Commercial Trust Bldg., Philadelphia. JOHN M. TITZEL, 412 Westinghouse Bldg., Pittsburgh, Pa., has been made sales representative in the Pittsburgh area. JAMES W. ANDERSON, of Dallas, Tex., has been transferred to Chicago where a district office was opened on September 1. WALTER G. KESSLING, of the home office, has been transferred to the Dallas, Tex., office.

HOYLE JONES has been made district sales manager, with headquarters in Tulsa, Okla., of the Republic Steel Corporation, Cleveland, Ohio.